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THE

ROCKY MOUNTAIN LOCUST,

OR

GRASSHOPPER,

BEING THE

REPORT OF PROCEEDINGS

OF A CONFERENCE OF THE GOVERNORS OF SEVERAL WESTERN
STATES AND TERRITORIES, TOGETHER WITH SEVERAL OTHER
GENTLEMEN, HELD AT OMAHA, NEBRASKA, ON THE 25TH
AND 26TH DAYS OF OCTOBER, 1876, TO CONSIDER
THE LOCUST PROBLEM;

ALSO

A SUMMARY OF THE BEST MEANS NOW KNOWN
FOR COUNTERACTING THE EVIL.

SAINT LOUIS:
R. P. STUDLEY COMPANY, PRINTERS AND LITHOGRAPHERS.
1876.

PREFACE.

On the first day of August, 1876, Gov. John S. Pillsbury invited to a personal conference the Executives of those States and Territories directly suffering from locust ravages, with the hope of obtaining concert of action in the best means of meeting the evil. Pursuant to this call, a Conference of said Executives and of other invited gentlemen was had at Omaha, Nebraska, on the 25th and 26th of October, 1876.

At said Conference the undersigned were appointed as a Committee to prepare, in pamphlet form, and to have 10,000 copies thereof published, the official proceedings, together with a condensed summary of the best means of destroying the locusts.

The following pages contain, therefore: 1st, the proceedings of the Conference; 2d, the practical facts and suggestions which the Committee has deemed best to bring together. The locust subject, treated at length, would require a bulky volume to do it justice; and we have dwelt, in the second part of this pamphlet, on those points that will more particularly be of present interest and value to the people of the country ravaged, and threatened next spring. The means recommended to meet and avert the evil are based not alone on our own experience, but on study of all reliable authorities. To expedite the publication of the pamphlet, we have more particularly culled from the special Minnesota Report, recently made to Gov. C. K. Davis, by a commission appointed for the purpose, and from the last two Entomological Reports made to the State of Missouri, to which last we are also indebted for the illustrations. We give this little work to the public in the hope that it may, by being liberally distributed, assist the people of the country interested, in overcoming future locust injury.

JOHN S. PILLSBURY,
CHAS. V. RILEY,
PENNOCK PUSEY.

Nov. 20, 1876.

PROCEEDINGS.

OMAHA, NEB., October 25, 1876.

A conference, composed of the Executives of various Western States and Territories, and of scientific gentlemen interested in the subject, assembled this day in the parlors of the Grand Central Hotel in this city, for consultation upon the locust or grasshopper question, and for securing comprehensive and concerted action for protection against the ravages of the insects.

At 2½ o'clock P. M. the meeting was called to order by Gov. Pillsbury, of Minnesota, who moved the appointment of Gov. J. L. Pennington, of Dakota Territory, as presiding officer of the conference. Gov. Pennington, while expressing his thanks for the compliment, thought all present would recognize the fitness of choosing Gov. Pillsbury for that position, both because of his having initiated the movement, and of his familiarity with the subject. Accordingly, upon his motion, Gov. Pillsbury was chosen president of the conference, and Prof. C. V. Riley, of Missouri, and Pennock Pusey, of Minnesota, appointed secretaries.

On motion of Gov. Garber, of Nebraska, all persons present feeling an interest in the subject were invited to participate in the proceedings of the meeting.

Upon the suggestion of Gov. Pennington, a complete list of the names of persons present as members of the conference, together with the names of the States and Territories represented by them, was prepared and read by the Secretaries, as follows:

MISSOURI,	-	GOV. C. H. HARDIN, PROF. C. V. RILEY, State Entomologist.
ILLINOIS,	-	PROF. CYRUS THOMAS, State Entomologist.
IOWA,	- -	GOV. SAMUEL J. KIRKWOOD.
KANSAS,	- -	GOV. THOMAS A. OSBORNE.

NEBRASKA, -	Gov. Silas Garber, Ex.-Gov. Robt. W. Furnas, Prof. C. D. Wilber, Prof. A. D. Williams, Hon. Geo. W. Frost.
MINNESOTA, -	Gov. John S. Pillsbury, Pennock Pusey, Governor's Priv. Sec. Prof. A. Whitman.
DAKOTA, -	Gov. John L. Pennington.

The organization of the Conference and the list of its membership being completed, Gov. Pillsbury, its President, briefly addressed the Conference, giving the following outline of its aims and objects:

The object of our conference, as you are aware, is to consider the locust or grasshopper question in its various aspects, and especially in that in which the insect presents itself as the inveterate enemy of our agricultural interests. This assemblage was suggested by the hope that through the collection of information and a thorough interchange of views among those who of necessity had given the subject attention, some comprehensive plan might be devised and a concert of action secured, which might prove in some degree commensurate with the magnitude of the evil to be encountered.

No subject, surely, transcends this question in urgent practical importance. From a casual appearance of the locusts in isolated localities more than a century ago, their visitations have grown of late years with such alarming frequency, and in such countless and destructive numbers as to create the profoundest apprehension for the primary sources of our prosperity. Since the year 1818 some portions of our extensive frontier, from Texas to our northern boundary, as well as the Pacific slope, have been invaded by the insects and subjected to their rapacity. Considering the sudden and fitful movements of the locusts, the limitless field of their operations and the mysterious and predatory nature of their inroads, they constitute a formidable enemy with which no single State or community can expect to cope successfully; and it is my profound conviction that an evil which, by threatening our agriculture, threatens the source of productive industry, deserves the prompt and thorough consideration of the general government.

If it be within the legitimate province of the Federal Government to improve our rivers and harbors in order to facilitate the movement of crops, surely the rescue of those crops from destruction is no less an object of its rightful care. If it be right for the Government to aid the promotion of its internal commerce, it certainly cannot be wrong to attempt the preservation of those primary products without which there can be no commerce.

In view of facts which seem to me indisputable and of the vast importance of the subject, I invoke your careful and earnest attention to such questions as may come before us looking to the furtherance of the object of our meeting. Various measures embodying the results of experience and observation will, I trust, be presented and wisely considered.

For myself I feel so deeply impressed with the magnitude of the evil which confronts us, and the urgent importance of comprehensive efforts for its arrest, that I trust I may be pardoned for indicating in advance some of the purposes which I think should claim our attention as of the first importance. Among these I name,

1st. A joint and urgent appeal to the President of the United States, to be signed by the executives here assembled and others favoring the movement, requesting him in his forthcoming annual message, or other suitable manner, to commend the subject to the prompt and favorable action of Congress.

2d. A similar joint request from this body to the congressional delegations from the States here represented and others interested, urging their assiduous efforts for the passage of an Act of Congress providing for the appointment of a commission of both scientific and practical men to consider the whole question, including cause and remedy, with adequate provision for suitable bounties for the prevention and cure of the evil.

3d. A joint memorial, if practicable, or some other form of combined official action by our several legislatures, asking the aid of Congress for these purposes, and to that end requesting the concerted and persistent influence of our several congressional delegations.

4th. Recommendations of the subject by the governors to the favorable consideration of the several State legislatures interested, invoking the adoption of such practicable measures as have proved efficacious, and such as further experience may suggest, including the repeal of existing game laws, or such modification of them as will prevent the destruction of birds which feed upon the insects; the offering of bounties for the destruction of eggs and insects; the prevention of prairie fires until a suitable time for the destruction of the young locusts by firing the grass. The encouragement of tree culture for promoting moisture and harboring birds, and such other means as may promote the great end desired. I cordially wish for such favorable results from this consultation as may be confidently expected of all sincere efforts deserving success.

Gov. Garber moved that the purposes thus stated and the plans of action outlined by Gov. Pillsbury be accepted and made the basis of the action of this Conference.

Gov. Hardin thought there might be other plans suggested, and as it might prove desirable to either enlarge or contract the scope of our aims, he moved, as an amendment, that a committee of three be appointed, to whom the President's address be referred.

After some explanation, in which it transpired that Gov. Garber's motion did not contemplate confining their action to the objects indicated by the President, but simply that it should be shaped by his suggestions, Gov. Hardin withdrew his amendment, and the motion of Gov. Garber was adopted.

It was suggested that the States be regularly called, and that their representatives successively express their views to the Conference; whereupon

Prof. C. Thomas, speaking for Illinois, addressed the meeting briefly. He expressed the fear that too much might be expected at the outset, both from himself professionally and from their Conference, in its adoption of practical remedies for the evil.

He had given the subject some consideration and study, and in regard to memorializing Congress, he thought the aid of the government should be obtained, 1st, in ascertaining information to counteract the ravages of the grasshopper; and 2d, the territories should be given substantial aid. The States should also aid and appeal to the several legislatures for assistance in bringing about such steps as are necessary to find out what to do and how to do it. He thought Congress was willing, and it should be recommended to take some action. The locust is a national insect, and demanded a national remedy. Asia and Europe have had the locust for one thousand years, but that does not argue against providing means for its suppression. He was satisfied remedies could be devised for meeting the plague. The chinch bug can be and has been met in other States. The locust has been met in Europe, and there has not been such an incursion since 1784. If we pass through it now, we may not look for trouble in the future. Illinois had no reason to fear the visitations of the insects, and he had, as State Entomologist, advised Gov. Beveridge that no action need be taken for protection against their ravages. Nevertheless, Illinois will cheerfully co-operate in any reasonable efforts to abate the evil in other States. He was disposed to think, however, that the present prolonged series of visitations was nearly at an end, the experience of Europe proving that the locusts follow an unascertained law, which limits the repetition of their ravages to a certain number of years in any one locality. But while this prospect should be held out to the farmers for their encouragement, it should not be relied upon, and should in no wise abate their vigilance. Both combined and individual action was necessary to prevent the hatching of the eggs in the spring, and he had little doubt that persevering action by all interested would achieve substantial exemption from loss.

Gov. Kirkwood, of Iowa, said that the destruction in that State had been confined to the northwestern portion, which had suffered severely for several years. The eggs have been laid in large quantity this season, in a wide area of the western portion of the State, and the danger was expressed that they might come another season in swarms. In northwestern Iowa the people are very careful to preserve the prairies from burning this fall so that they may destroy the young in the spring. On cultivated ground, a means of destruction frequently used was by spreading hay or straw over the surface. At night the young insects would gather under it, and immense numbers were burned up in this manner. Plowing is resorted to this fall in some localities for the purpose of covering the eggs deep, by which, it is said, they will rot. Other methods have been used, such as catching them, and machines have been invented for this purpose. Rolling the ground in the spring had also been suggested as a means for destroying the young insects. What was urgently necessary was an immediate method for saving next year's crops, and he was anxious to hear of a plan adequate to that desired end.

Gov. Pennington, speaking for Dakota Territory, said he had no remedies to suggest, and had little faith in any plan of extermination. He was disposed to think the best course to pursue was to plant and raise such crops as can be grown in spite of the pests. He was satisfied that no grasshoppers were actually hatched out in Dakota, but the full-fledged pests swooped down upon them from elsewhere in countless millions. In other places, where the insects can be attacked in their helpless infancy, it may be possible to rescue crops by a vigorous warfare upon them; but where they literally cover everything, in full maturity, inches deep, it was folly to talk of saving crops from their rapacity. The most practicable method to secure exemption was to cultivate only such crops as mature early in the season. This was true of Dakota, at least. One year our fine corn crop was totally destroyed: while the wheat, oats, potatoes, and other crops were abundant. In 1874 the damage to wheat was not more than ten per cent., as it was ripening when they came. He did not expect them every year, but they should be prepared for them. His advice would be to plow in the fall, and plant early crops, which would mature before the grasshoppers reached them. They had not come to Dakota until late in July, and sometimes in August. The moral effect had been worse than the actual loss upon emigration, by sending for aid out of the State. During the season when aid was secured, there was a large surplus of wheat and other products sent to eastern markets. The summer of 1874 the locusts came from a northeasterly direction. In 1875 no damage was done, as they passed over and did not light. In 1876 the damage to wheat was not five per cent., and a large surplus was being shipped to market. Corn was one-fourth to one-half crop.

We are always able to raise an abundance, and this ought to inspire confidence. We can feed the grasshoppers and still have a surplus. They came from the north as far as the British possessions. The evil was a wide spread one, and the damage was great enough to appeal to Congress. If we get no relief we shall get knowledge by a scientific commission. In his view, one of the best purposes of this conference was to inspire confidence and encourage producers, by dispelling senseless rumors and the dissemination of rational ideas. It became him to be modest, representing as he did only a ward of the nation rather than a sovereign State. Still, he probably represented as many grasshoppers as any one present, and he was ready to co-operate with the gentlemen in any practicable plan they may see fit to adopt. But he desired to repeat that he was utterly opposed to alms-giving in any shape, as in all respects demoralizing and ruinous to the recipients.

Gov. Hardin, of Missouri, said he came to learn from others, and he felt a deep interest in the subject. Yet it was difficult of comprehension. The grasshoppers had spread themselves over a range of more than a thousand miles, and he feared it was beyond the power of man to control their ravages. He said that thirteen or fourteen counties in Missouri were totally ravaged by the grasshoppers in 1875, and the people were saved from starvation only by liberal contributions from more fortunate counties. He was decidedly favorable to congressional action for the arrest of the evil, and believed that few objects could afford a more legitimate field for the exercise of its power. He was also favorable to vigorous State action, believing that all able-bodied men should be called out in the needful emergency as for defence against a common enemy.

The Governor, in closing, called for Prof. Riley, the State Entomologist of Missouri, whom he had asked to accompany him, and who, he said, was thoroughly familiar with the subject.

Prof. Riley, in response, said that of this question he was disposed to take the brighter view. He had given it much attention. He saw no reason for discouragement. He had long studied the subject and investigated the insect, in five or six of the States, from the mountains to Missouri. His two last reports were largely occupied with it. He proceeded to give a very instructive resume of the entire locust question, in the course of which he gave it as his belief that the vast swarms which overrun the States partly represented in the Conference, had their origin in the extreme northwest of the country lying east of the base of the Rocky Mountains, and reaching away up into British America. Some things about the pest were positively known, and before proceeding with his views he would reply to two statements just made. First, our swarms do not, as many people imagine, come from Asia. The Rocky Mountain Locust is an American insect, and the migratory and devastating species of Europe, Asia, and Africa, are specifically quite different, though belonging to the same family. Second, the young insects do hatch in Dakota, and their ravages had at times been quite serious. He read reports from the signal service observers at Pembina and Bismarck, in confirmation of his statement, and showing that they hatch in Northern Dakota in June, and obtain their wings in July. The fact that Gov. Pennington had never seen the young in southern Dakota was to him very interesting, and confirmed the views he had always held, that the native breeding places are still further north. When forced from hunger and other causes to migrate from their native home, these winged hosts fly over Dakota as they fly over the States to the south and east. Without wind they move only fifteen or twenty miles a day, but with strong winds they travel ten times as fast, and in the course of a month may be carried many hundred miles. South of the 44th parallel and east of the 100th meridian, the insect could not permanently thrive, and in most of the country this side those confines the progeny from the invading swarms leaves for the northwest as soon as fledged. The young travel but a few miles east of where they hatch, and the winged swarms have never done any damage east of a line drawn through the center of Iowa, and in all probability never would.

Coming to the points which more particularly concerned the Conference, he said there were two principal questions for solution: 1st, how best to avoid the injury that threatens from the young next spring, over large portions of Minnesota, Iowa, Nebraska, Colorado, Kansas, Missouri, Texas, and Arkansas, where eggs have been or are being laid; 2d, how to prevent in future the winged swarms from migrating from the northwest and invading the country to which the species is not indigenous.

For the first, more immediate emergency, he believed that the Conference would do much to earn the gratitude of the afflicted people, if it could put into practical operation over the threatened country the suggestions made by Gov. Pillsbury in opening. The eggs are thickly laid over many hundred square miles, and some organized plan of harrowing or plowing them under this fall should be adopted. With a mild, freezing and thawing winter, the great bulk of these eggs may be destroyed, and we may have in 1877 the comparative harmlessness of 1867 instead of the injury of 1875; but it will not do to count on. Ditches should be extensively dug. A ditch two feet wide and two feet deep, with perpendicular sides, is the best protection against the young insects after they begin to travel. An orchard, field, or garden, surrounded with one, can be protected. The young insects, when they first hatch, and when they are sluggish and congregate together, should be destroyed by burning, crushing, rolling, ditching, and every other means; and he would recommend farmers to delay planting next spring until the young were thus exterminated. What is wanted is organization. He suggested that a man for each State be authorized to travel all winter, learning the points where the eggs were laid thickest, organizing, and disseminating information as to the best methods of dealing with the plague.

He believed it would pay each of the States to have a State Entomologist. Each State should also encourage the collection of the eggs, by a liberal bounty of five or six dollars a bushel for them; also the destruction of the active insects, by a graded bounty of one dollar a bushel when they first hatch, which will be from March to June, according to the latitude, and decreasing with each subsequent fortnight. For the solution of the second question, he believed with Gov. Pennington, that man was comparatively powerless before the ravenousness and mightiness of the winged swarms when they swoop down upon the more fertile country, but that there was a possibility of preventing their invasions. He was decidedly of the opinion that the Government should take some steps toward it. He believed that this locust was the greatest drawback to the settlement of this western country, but Congress regarded anything with the name of "bug" attached to it as something to be laughed at.

Notwithstanding the appropriations for topographical surveys, harbor improvements, etc., it would be difficult to get $20,000 for this purpose. Congress would not understand the magnitude of the subject unless strongly appealed to. He thought that the best way to secure aid would be by demanding that a competent commission for the purpose of making the needed observations, be added to Hayden's Geological and Geographical Survey of the Territories, with proper appropriations therefor. He was satisfied that nothing could be looked for from the Department of Agriculture. Prof. Hayden was an experienced explorer, was already familiar with much of the country to be visited, and could in many other ways give assistance to such a commission; while his support of the measure in Washington would be valuable. Finally, he insisted that the farmers in the locust country should not leave the country. The locust is not an annual trouble in most of the country so threatened next spring, and will in time leave, not to return perhaps for several years. It will not be permanent with us. This year's visitation is unprecedented, so soon following the general invasion of 1874.

Prof. Thomas asked whether he was not justified in his forecast by the experience with the insect in Europe.

Prof. Riley said that it was hard to draw any analogy between our locust and those of Europe; but that in respect to their periodical visitations into the country where they are not indigenous, from high mountainous regions, and their ultimate abandonment of the invaded country, there was analogy.

Referring to Prof. Riley's statements about the efficacy of ditching as a protection against the young insect. Gov. Kirkwood asked what would be the number of ditches required on an ordinary farm.

Prof. Riley replied, that a field of whatever size should be surrounded by a ditch to protect it from incursions from without, and that pits or cross ditches might be made for the destruction of those hatching within the field—the number depending on the number of eggs which could be ascertained by examination in various parts of such field.

Gov. Pennington remarked that he was satisfied that the habits of the 'hopper were different in different places. Hence, that which might be of value in one locality would be useless in another. In southern Dakota the grasshoppers came down from the heavens, and these ditches would not interfere with the insects.

A brief discussion then ensued between Gov. Pennington, Prof. Riley, Gov. Kirkwood and Prof. Thomas, in which it was evident that the plans for protection against the winged 'hopper were different from those to be employed against the young, hatched out pests. This important distinction was thereafter recognized in the discussions, in order that different plans might be suggested for each class of the insects.

Gov. Garber being called upon for a response for Nebraska, said that he had little knowledge of the subject and no plan to propose for correction of the evil. He, however, heartily favored the proposal for Congressional aid, and he gladly welcomed this effort to secure combined and comprehensive action. He called upon Ex-Governor Furnas and Profs. Wilber and Williams, all of whom had given the subject close attention.

Ex-Gov. Furnas in response, said that as a farmer he did not fear the locusts, although he had suffered severely from their ravages. He was glad to see the scientific men come to a practical consideration of the question. The primary object in view was the destruction of the young 'hopper, which was to hatch out next spring. He believed that a long time would not be required if there was a combined effort. The 'hopper usually selected a clear, bare, dry spot, and, in his farm of 220 acres, he was satisfied there was not over one acre occupied as a laying spot, although the roadsides were full of eggs.

His experience was that the young insect did not eat nor move much for the first ten days, and, therefore, they should be destroyed while very young. They could be killed in those first few days with a hickory broom or a spade, as they huddled together, or a mere touch of coal oil would kill them.

He believed that, with one day's labor in the fall and another in the spring, taking every man who labors, he could save the crops throughout the State.

Prof. Williams, of Nebraska, spoke of the habits of the locusts and the prospects respecting their future ravages in his section of the country. He said that near Kearney Junction no eggs had been laid previous to this year. Their course hitherto had always been northward, and they had not usually alighted in the spring. The damage had been done by the south-going hordes late in the summer and early fall. This was all in reference to the flying 'hopper Some good had been accomplished by smoking them away, by sulphur, and by ropes dragged over the grain. They had, however, taken most of the crops where they had been, for the reason that the people could not defeat the great numbers which succeeded each other, though they might keep the insects off for a time. In Prof.

Williams' locality they had usually selected plowed ground, grass land or sandy land to lay their eggs in. It was also noticeable that, already this fall, some of the eggs had hatched out, and many of the young 'hoppers had been seen; but they disappeared very quickly from one reason or another, rain, birds, and cold, and the people hoped that they might on this account be less troubled by them next spring. Near Leavenworth, a gentleman had saved a fine orchard by simply tying small bunches of cotton batting around the trunks; when the insects would climb up, they got entangled and fell back. In Colorado he had understood that they had so successfully fought the pests as to have saved their small grains the present season, although they had lost their corn.

Gov. Pennington has seen people fight them for three days and lose their gardens at last. A lady at Yankton covered choice plants with canvass and they ate that off.

Prof. Williams observed that the insects which came last year were apparently a very debilitated race, many having parasites upon them, which were rapidly destroying them; while those which came the present year were more active and hardy.

Mr. Pusey, upon the call for Minnesota, said that with their permission, he would read the proclamation of Gov. Pillsbury, issued in August last, recommending various practical experiments for resisting the locust ravages. He said he supposed some of those present had probably read the document, but as it embodied some points which had elicited some discussion, he felt that an apology was scarcely necessary for its re-production here, especially as the several remedies suggested were the results of successful experience. The proclamation is as follows:

STATE OF MINNESOTA,
EXECUTIVE DEPARTMENT, ST. PAUL, August 30, 1876.

The continued and increasing ravages of the locusts or grasshoppers in many of the Territories and States of the Union, have been deemed sufficiently serious to warrant a meeting of the Governors of such States and Territories for consultation, with a view to seek congressional aid, or otherwise secure combined action in resistance of the growing evil. Such conference has been called to meet in October. Meantime the widening area of the visitations of these insects in this State induces me without delay to urge the people whose interests are most directly involved, to assemble in public meetings in their several localities, for the purpose of collecting information, interchanging views and devising plans of concerted action for the destruction of the insects, and for a common defence against their ravages. Both the correction of exaggerated reports, and the promotion of an intelligent apprehension of the actual evil to be encountered, it is believed, would result from this course, while the hope of thus attaining practical means of mutual protection, certainly justifies a united and energetic effort in behalf of an object common to the public welfare.

It is the concurrent belief of all who have given close attention to the subject that it is practicable to destroy the pests in great measure or to ensure a vast mitigation of the worst results, by the timely, concerted and persistent efforts of the several communities directly concerned, and the employment of simple agencies readily available.. To this end I have taken pains to collect from the most reliable sources, information of the several modes which have been successfully employed, which I here detail for the consideration of all concerned, and I earnestly invoke the united and resolute action of the people in a manful defence against a common enemy:

First. The crushing of the insects by rollers and other implements, and the catching of them by bags and traps during the season of copulation or mating, when by reason of their stupid and inactive condition they may be destroyed in vast numbers. This is the first and vital step towards their destruction, and can be resorted to immediately, the insects being in the condition named from about the middle of August variously until the approach of cold weather.

Second. The plowing under deeply of the eggs and the thorough harrowing of the bare, dry knolls and other comparatively small, warm spots where the eggs are deposited, so as to dislodge them from their cells or pods, which destroys their germinating power. New breaking being a favorite resort for such egg deposits, this mode of destruction is readily available in the ordinary course of farm work, for which purpose these operations should be delayed till as late a period in the fall as practicable.

Third. Co-operative action for the preservation of the prairie grass until the proper season for its burning in the spring, by means of extended fire-guards along township boundaries or other large areas, to be accomplished by means of plowed strips or by wide parallel furrows and the careful burning of the intervening space. The burning of the grass thus preserved, when filled with the young grasshoppers in the spring, has been found to be a very effectual means for their wholesale destruction.

Fourth. The placing of loose straw on or near the hatching places, into which the young insects gather for protection from the cold in early spring, where they may be destroyed by firing the straw at the proper time. To this end straw should be carefully saved and not needlessly destroyed at threshing time.

Fifth. The construction of deep, narrow ditches. with deeper pits at intervals, as a defence against the approaching insects in their infant condition. Into these the young, when comparatively helpless, accumulate in vast numbers and perish.

Sixth. The sowing of grain in "lands" or strips, fifty to one hundred feet wide, leaving narrow vacant spaces through which to run deep furrows and construct ditches into which the young grasshoppers may be driven and destroyed.

Seventh. The catching of the insects at various stages, and especially when young and comparatively inactive, by means heretofore employed, and by such improved instruments and processes as our experience may suggest.

Eighth. And, finally, the driving of the winged and matured enemy from the ripening grain by passing over it stretched ropes continually to and fro, aided by annoying smoke from burning straw or other smudges, and by loud and discordant noises made by striking tin vessels, and by shrieking and yelling with the voice, which are said to aid in disturbing the pests and inducing their flight.

Let the common enemy be thus fought at every stage of his existence and at every point of his attack. Each one of the modes here prescribed will doubtless aid to reduce the grand total of the annual destruction, while all of them, faithfully pursued in succession, together with other methods to be devised, it is confidently believed, will achieve substantial exemption from loss or avert its saddest effects. But should all means fail there will remain the consciousness of having made such helpful and assiduous attempts as deserved success.

The danger of weakening the habit of self-reliance among the people, as well as the difficulty of reaching the most worthy recipients of public aid, renders the distribution of seed grain and other assistance heretofore extended to the sufferers, of very questionable policy; and I feel it my duty to warn all persons against relying upon public aid of this character. Whatever action may be taken by the next Legislature or by Congress should wisely contemplate future protection rather than indemnity for past losses, and if practicable should discriminate in favor of such as evince a disposition to help themselves. At all events if aid or succor of any kind or from any quarter may reasonably be expected, it will be both better deserved and better employed after courageous and determined efforts shall have been made for self protection.

J. S. PILLSBURY, Governor.

Upon the conclusion of the reading, Prof. Riley declared the paper replete with excellent practical suggestions, and therefore moved that the proclamation be accepted and adopted as a part of the formal proceedings of the convention. But he desired at the same time to combat the idea embraced in the first recommendation, that the insects at the period of copulation are feeble and inactive. On the contrary it is precisely then that they are most vigorous. Those that are inactive and stupid are more particularly the males that have already copulated, and the females that have finished laying. The large majority that would thus be caught would therefore have already done their principal mischief, and would soon naturally die. The method is not, therefore, so useful as it seems, though he would by no means discourage it.

This view was confirmed by Prof. Thomas, who affirmed that at no other time were they so active and formidable.

Mr. Pusey, in reply, disclaimed any scientific knowledge of the insect, and even such information as came of close and continuous observation; but he affirmed as the concurrent opinion of many sufferers from the insects, that the recommendation for crushing and catching the insects at the time named, was effectual for the end proposed. The scientific gentlemen may be right as to the vigor of the locusts at the period of copulation, but in that case there must be sufficient interval, after that period and before the deposit of the eggs, to permit of their destruction. At all events, there was little doubt that the egg deposits and the young broods were vastly decreased in consequence of the prior crushing of the stupid adults. Co-habiting and egg-laying, it was well known, occur at various periods, from mid-summer until the approach of cold weather, and the insects are less active late in the season, even when cohabiting, and are then easily destroyed. Mr. Pusey further stated that spring breaking which awaits the next year's seeding, was a favorite resort for egg deposits in Minnesota, and that thorough harrowing of such ground late in the fall was an effectual means of extermination, by destroying the germinating power of the eggs.

Gov. Pennington seconded the motion to incorporate Gov. Pillsbury's proclamation as a part of the formal proceedings of the convention, and the motion was carried.

The Conference then adjourned until 7½ o'clock in the evening.

EVENING SESSION.

Upon the re-assembling, the Conference called for some remarks from Prof. C. D. Wilber, who as the agent of the Burlington and Missouri R. R. Company, had given the subject much attention. Prof. Wilber spoke as follows:

" The locust or grasshopper question applies now to all that portion of our country lying west of the Mississippi river, and has become a national instead of a local topic. This assemblage of governors from the western states and territories, and the pledged co-operation of those who are unable to be present, prove that the western half of the continent is deeply concerned in providing ways and means of defence against the locust plague. Hence, by the business relations of the west to the east, the entire country is interested in the deliberations of this congress.

"The objects sought to be attained by this meeting are two, viz:

"1. The securing of national aid in prosecuting inquiries and research concerning the locusts in the distant or mountain regions, where they are said to originate, with a view of ascertaining such facts as may assist in exterminating them at their source or native haunts.

"2. To discuss such plans as may be advisable in defending the localities now threatened by them during the coming year of 1877—or such regions as are now occupied by their eggs.

"There is no doubt as regards the assistance sought for from the government. The emergency is so great and applies to so many millions of inhabitants, and nearly one half of our commonwealth, that our representatives and governors and others in authority will all unite in obtaining the aid needed to prosecute the scientific research referred to.

"The subject which most concerns us is the adoption of any or all the successful means already known, or such as may be provided, for a general and systematic crusade against locusts next year.

"It is not certain that we shall have the impending invasion in 1877. They may wholly disappear, as they did from Iowa in the spring of 1867, without doing any damage.

"Within the last thirty days I have examined many thousands of the eggs in southeastern Nebraska, and find a large proportion already destroyed. Those in the hard ground, such as roadsides, are best preserved; while those in soft ground, such as stubble cornfields or gardens, are to a very great extent carried away or consumed by some predatory insect. But whatever the results may be in the spring, it is wise, meanwhile, to disseminate among the people everywhere descriptions of every known device or remedy, whether mechanical or chemical, by which we may secure partial if not good average crops. The people are generally uninformed on this subject; they do not know what to do. Arm them with reliable facts, modes of destruction, and we will have a home army of millions of men who will fight vigorously for their farms and gardens.

"Those who understand these matters in Nebraska, have succeeded in driving off hordes of these locusts, and saving their crops. Gov. Furnas, who last year lost heavily by them, has now no fear either as to his farm or nursery. 'He has met the enemy and they are his.' His modes are exceedingly simple, as he has explained them. Another man in this same county raised one hundred acres of wheat by making a ditch as a barrier, against the creeping, unfledged locusts—the ditch sloping to the coming hosts, but steep on the other side.

" One man in Saline county invented a long box and placed it on wheels so that it would catch all the locusts as it approached them. By this means he saved his corn field.

" Another man, in York county, burned brimstone in a large pan, with a long handle, and drew it through his cornfield after the flying locusts had taken the country, and he was successful in saving his entire crop.

"Again, the Mennonites came to Nebraska in 1874, and when they saw the first invasion of locusts in August of that year did not mind them in the least; nor have they manifested any concern or alarm since. The reason is, the Mennonites were familiar with them in Russia, and knew how to fight them successfully.

"Some of their modes, in addition to cutting ditches, are as follows: In the spring, as the locusts begin to appear, they are driven, by pushing them with brush or brooms to the grass or prairie, which is set on fire, that is, just that portion of the prairie which has received the horde from the plowed field. The prairie fire is then put out, and as they appear day by day, more locusts are driven to the grass, which is also burned, and so on until all have been destroyed.

" When the locusts are coming in swarms from abroad, the Mennonites build small smoke fires, with dry or damp straw or prairie grass, making fires at intervals of a few rods over a forty or eighty acre field. These fires or smokes are kept until the locusts have passed over; and in this manner the crop is wholly or partly saved.

" But it is necessary to familiarize the people with these cheap and simple modes of destruction, and while much can be done through the press, much more can be done by organizing the counties, towns and districts or precincts into locust clubs, under the authority or direction of the governor of each State or Territory, who may send some competent person or persons over the State, to assist in perfecting such organizations and selecting the most available men as local committees, who can receive and distribute such printed matter as the governor may, from time to time, forward for distribution. In this way, a whole State may be thoroughly organized for the campaign, and the entire population will become enthusiastic in preparing for and carrying on this warfare. The locust is, after all, only one of the foes of the farmer; he is often menaced and injured by the drouth, which in all countries may continue for several successive seasons. Then he has a contest continually with a whole catalogue of weeds, whose name is legion; he must conquer those or lose his crop. Next comes the weevil, chinch-bug, potato-bug, army worm, etc., etc., etc., each insisting upon this crop or that, as suits his taste; so the farmer and gardener have to fight constantly from spring until fall, in order to live. The locusts may therefore be regarded as only another, but perhaps most dreaded of the farmer's foes, and he has no alternative but to maintain his ground and raise his crop and support his family in spite of them.

"It is the height of folly to relinquish a farm and a home by the temporary assault of any of these pests or plagues. It is best to fight it out if it takes one or more summers. These plagues come and go according to laws which we do not now comprehend, and they will continue to do so in all parts of the United States, and all over the earth. It is only a temporary pressure which is upon us, and the only manly course for us is to resist the locusts by every means within our reach.

"The inhabitants of the vast district now represented by the governors of the Western States and Territories, not long ago composed a grand army of fighting men. The victory they secured was the permanent peace of our country. They are still in the same grand army, reinforced with families, and if they are provided with adequate knowledge and facts concerning the locusts, ways and means of defense, and organized into companies in the manner indicated, they will still fight more valiantly, and maintain their homes and farms in the great West."

Hon. Geo. W. Frost, of Omaha, said he had been in this part of the country for about twelve years. He thought that the greatest battle was to be fought with the 'hoppers which were hatched out in the vicinity. The flying insects could be prevented from doing much damage by keeping them moving. They also never came into the vicinity of shade, and the Timber Culture Act would do much toward saving the country. Mr. Frost then gave a history of the aid work done to save the people from starvation, showing how really necessary the work had been. He defended the character and actions of the agents who had solicited assistance, and denied that they had spread sensational reports as had been charged, but had corrected exaggerated rumors and worked faithfully for a benevolent purpose, and he believed had accomplished much good.

Gov. Pennington, in reply, disclaimed any intention to reflect upon the motives of aid solicitors, whom he thought generally good and well-meaning people, but he would reiterate his condemnation of the policy of soliciting and giving alms, as unfortunate, ill advised, mischievous and demoralizing to the last degree, the deleterious effects of which it would require ten years to obliterate. He denied that there had ever been any destitution in Dakota which the people of the Territory could not themselves easily alleviate.

Gov. Osborn, of Kansas, having now joined the Conference, was invited to express his views as to the condition and prospect of affairs in his State. He stated that he imagined the various aspects of the subject resolved themselves practically into two vital questions: First, what can be done immediately to save our crops next year? and, second, how can we get rid of the pests permanently? Last year Kansas had an immense crop, and exported some 14,000,000 bushels of wheat. This was raised in the western part of the State; in the eastern portion the grain had been entirely eaten off. Perhaps 70,000,000 bushels of corn were also raised last year. This year the grasshoppers had, with few exceptions, perforated the entire State with holes and filled them with their eggs, and there is great fear and uncertainty respecting next year's crop. Yet the people are less discouraged than during former trials of this kind, and they do not mean to beg. They have gained fresh hope within a few weeks past; are forming clubs and mutual aid societies, and are determined upon a vigorous fight with the pests. Possibly his people were looking to this Conference for moral aid and information. The war must be waged and the persevering enemy met at every point, or the country be abandoned. There was no alternative.

He spoke of having met Mr. Henry, one of the largest wheat growers this side of California. He had about 1,800 acres in wheat and had added this year about 700 or 800 acres, all of which had been eaten off. Mr. Henry was rather discouraged, but lately he had gone to work with his neighbors to make another good fight.

Gov. Osborn said that the most important thing was to re-instil confidence in the minds of the people, so that they should be certain, when they put a crop in the ground, that they would raise that crop.

Prof. Riley reiterated the importance of certain recognized practical remedies to be applied promptly at the proper time, and corrected some fallacious reasoning commonly employed upon the subject. He concluded by moving the appointment of a committee of five to consider the various propositions submitted—the methods proposed for immediate protection from next year's ravages—the proposed memorial for Congressional aid and other matters, and report resolutions upon these and other propositions for the consideration of the Conference.

Prof. Williams said he desired to impress such committee with the importance of inspiring confidence among our disheartened farmers to prevent their desertion of a country so repeatedly devastated; and he embraced the occasion to thank Gov. Pillsbury for his timely proclamation which he declared had done more, with its simple, practicable methods for killing the insects and destroying their eggs, to re-assure the people of Nebraska and encourage them to new exertions than all other publications upon the subject.

Prof. Thomas confirmed this estimate of the value of Gov. Pillsbury's proclamation, and urged the importance of assuring the people of the possibility of achieving substantial relief.

The committee was then appointed and increased in number to seven, Gov. Pillsbury being Chairman, as follows: Gov. Pillsbury, Gov. Osborn, Prof. Riley, Prof. Thomas, Prof. Wilber, Gov. Pennington and Prof. Whitman.

Gov. Pennington submitted a resolution, recommending the people in the afflicted States and Territories, in view of the inadequacy of mere human efforts and appliances to avert so vast an evil, to invoke Divine aid to their relief, by offering special prayers in their several churches. He deprecated any discussion of the subject, but desired that the resolution be referred to the committee.

Gov. Pillsbury stated that he had received similiar recommendations from various sources, which he desired also should be referred to the committee.

The Conference then adjourned to 9 A. M. of the following day.

THURSDAY, October 26, 1876.

The discussions of the previous sessions of the Conference had covered most of the essential features of scientific and practical character pertaining to locust invasions and the habits and movements of the insects. The various propositions growing out of these were referred last evening to a committee for definite action. Pending the report of this committee, which was unavoidably delayed, the members assembled informally and exchanged views upon the topics before them.

Prof. Riley had on exhibition a fine glass case of specimens of the various species that occur in this country and are often confounded;

but the *spretus* (Thomas) or Rocky Mountain locust, was the insect that caused the wide-spread havoc. Gov. Pillsbury had a number of vials containing the eggs, which were presented for examination. Sylvester's grasshopper machine and other implements for catching the young insects were exhibited and commented upon. In the informal discussion of the forenoon session, Prof. Riley stated among other things, that the locust eggs, which are collected for bounties, might be utilized by the authorities who received them. They were excellent food for hogs and poultry.

The Conference was formally called to order at 11.30 A. M.

Gov. Garber announced that the Mayor of Omaha desired to extend the courtesies of the city to the members of the Conference, and had provided carriages which were at their service whenever convenient to take a view of the city. On motion of Gov. Hardin, the thanks of the Convention were returned, and the invitation of the Mayor accepted, the hour of two o'clock, P. M. being fixed upon for the proposed ride.

Prof. Riley, on behalf of the Committee on Resolutions, read their report, as follows:

Your Committee, appointed to draft resolutions expressive of the views of the Conference, would respectfully report as follows:

The Rocky Mountain locust, or grasshopper, by its migrations from Territory to Territory and from State to State, destroying millions of dollars' worth of the hard earnings of the Western farmers, crippling the progress of the border States, and retarding the settlement of the Territories, has become a national plague. Its injuries are of such magnitude that no effort should be left untried that will be likely to diminish or avert them.

The work to be done is of a two-fold nature—State and National. From the writings of those who have given the subject careful attention, and from our own past experience, it is quite manifest that the pest in question is not a native of the country south of the 44th parallel or east of the 100th meridian, but that it occasionally overruns the country south and east of these lines, from the extreme northwest.

There are, therefore, two pressing questions which demand our attention.

1st. The best means of fighting the plague as it occurs in the States to which it migrates, but in which it is not indigenous.

2d. The thorough investigation into its habits in its native home, with a view of preventing, if possible, its migrations therefrom.

Toward the elucidation and settlement of the first we have the dear-bought experience of the past few years, and there has already been a large amount of valuable information obtained and published in the proclamation of Gov. Pillsbury, in the report of the special Minnesota commission, appointed in 1875, in the two last entomological reports made to the State of Missouri, by its State entomologist, and in the writings of Prof. Thomas and others. We, therefore, recommend the passage of the following resolutions:

Resolved, That, as much valuable and practical advice has already been published, a committee of three be appointed to collect and issue in pamphlet form, as soon as possible, all the more practical means, based on experience, that we now have any knowledge of, toward the destruction of the insect, whether as it pours down upon us in the winged condition, or as it hatches out in our midst.

Resolved, That the official report of the proceedings of this Conference shall form the prelude to this pamphlet, and that the following recommendations and statement of our views as to the possibility of contending with the locust shall form a part of said pamphlet.

[These statements will be found in their proper place, preceding the second part of the pamphlet.]

Further, in order to meet the emergency that threatens next spring, particular stress should be laid on the best means of coping with the eggs and unfledged young that will hatch from them in the spring of 1877. Among these, we deem as most feasible and best calculated to produce good results, a judicious bounty system; and, as that recommended by Prof. Riley, in his eighth report, is based on the valuable experience gained in 1875, and correctly states the principles that should govern such legislation, we recommend the following:

Resolved, That in our opinion it will be wise and politic for the legislatures of each of the States and Territories most deeply interested in the locust question, to enact a State bounty law, offering a bounty of ——— per bushel for the collection and destruction of the eggs, and of ——— per bushel for the destruction of the unfledged insects; that the principles laid down by Prof. Riley for such a law should be kept in view; and that we will use our influence to obtain such a law in our respective States.

Resolved, That we recommend to the several legislatures, that they authorize local taxation for the purpose of systematized effort in the way of ditching, burning, etc., as the local authorities may deem necessary or desirable.

We further invoke our legislatures to adopt such practicable measures as have proved efficacious, and such as further experience may suggest, including the repeal of existing game laws, or such modification of them as will prevent the destruction of birds which feed upon the insects; the prevention of prairie fires until suitable time for the destruction of the young locusts by firing the grass; the encouragement of tree culture for promoting moisture and harboring birds, and such other means as may promote the great end desired.

Resolved, Further, That in view of the danger that threatens, it is advisable that, as far as possible, a survey be made of each State during the coming winter, to ascertain just those portions of each county in which the eggs are most thickly laid, in order to indicate to the County and State authorities the amount of the preparatory work to be done to prevent the threatened injury, and also in order to more thoroughly organize every portion of each State on some plan of securing the intelligent co-operation of farmers and others.

We also recommend the passage of the following resolution:

Resolved, That the Governors of each State and Territory be advised to appoint a commission of one or more competent persons whose duties shall be to visit the counties and towns of each State and report the facts and observations to the Governors, and also to organize each county and precinct in such manner as may be deemed expedient, and also to appoint in said counties and precincts suitable persons to receive and distribute such documents and pamphlets containing general information and means of defence as will be provided by this Conference, and to report such organizations and names of committees to the respective Governors.

For the solution of the second question, it is the evident duty of the Government to make the proper investigation. We have looked in vain for this aid from our Department of Agriculture, and are satisfied that under its present management such aid, or any thorough investigations, are not to be expected. We therefore recommend the following:

Resolved, That we deem it the duty of the National Government to make some effort to destroy or counteract this great pest and thus prevent its injuries.

Resolved, That we believe the first step in this matter should be a thorough investigation into the history and habits of this insect in its native haunts as well as in the sections visited by it; and the search for all possible means of its extermination, and remedial agencies which may be used against it.

Resolved, That we believe this can be accomplished in the shortest time, at the least expense and most effectually by attaching a special commission for this purpose, to one of the Government surveys sent out annually to the West; and, therefore, we suggest that the following be added to that clause of the Sundry Civil Appropriation Bill, making an appropriation for the geological and geographical survey of the Territories; "And also the further sum of twenty-five thousand dollars for the purpose of paying the salaries and expenses of a commission to consist of three entomologists and two Western men who have had experience with the locusts, to be appointed by the Chief of said survey, with the consent and approval of the Secretary of the Interior. It shall be the duty of said commissioners to examine into the history and habits of the said locust, and make report thereon, and also suggest such means of destroying them or remedies against them as their investigations shall prove most practicable."

Resolved, That it is our belief that the Signal Service might materially aid such a commission as here demanded, in performing the work, by regular observations made of the time, direction, extent of flights; time of hatching and leaving of the young locusts, etc.; also, by announcing in the daily weather reports the appearance and progress of the swarms; and we ask of Congress to grant to Gen. Meyer such additional assistance and means as will enable him to carry out this work.

Resolved, That the President of the Conference be requested to draw up and present to the President of the United States, a letter setting forth the urgent necessity for some action on the part of the general Government in behalf of the sections ravaged, in reference to the invasions of and destruction occasioned by the locusts.

Resolved, That each of the Governors of the following States and Territories, to-wit: Minnesota, Illinois, Iowa, Kansas, Nebraska, Missouri, Colorado, Wyoming, Dakota and Idaho, be requested to transmit to their respective delegations a record of these proceedings, requesting them to urge upon Congress speedy action in this matter, in accordance with the recommendations of this Conference.

On motion, the report was ordered read section by section, and the resolutions discussed and voted on *seriatim.*

The first section was read.

Mr. Pusey, the Secretary, wished a slight change in the reading.

Gov. Osborn wished the report to say that the festive 'hopper was not a native of Kansas, Nebraska, or Dakota; that Pennsylvania a hundred years ago was eaten out by them.

Gov. Kirkwood said that the danger was not of a local character, but national.

Prof. Wilber said that all sections of the Union had at different times been afflicted, and it was well to be known that the odium of a grasshopper country could not he attached to these States alone.

Gov. Osborn said it was not fair to advertise to the world that this country was a grasshopper country, and the only grasshopper country.

Prof. Thomas said that he represented Illinois, and that was not a grasshopper country, and he did not believe it ever would be; but they had the chinch bug, which he believed had done more damage than the grasshoppers ever had done. He didn't want to advertise it as a grasshopper country too.

Gov. Osborn said that Maine and Pennsylvania had been eaten three or four years in succession, in times past, and we might as well tell the whole truth. This was not the only country that ever had been infested with grasshoppers.

Gov. Kirkwood asked Prof. Thomas how he could tell that the grasshoppers would never reach Illinois.

Prof. Thomas answered that from the known habits of the insects; he could not tell positively, however; the climate might change; the habits of insects sometimes changed; but there was no reason to expect any change in the habits of this locust.

Gov. Kirkwood asked what was to hinder them, when they once arose to migrate, from going into Illinois—why they might not as well fly east as south?

Prof. Thomas said the currents of atmosphere were well known, and they did not carry them in that direction.

Gov. Osborn said he had read the reports of Prof. Dwight, of New England, and that they had done just as much damage there.

Gov. Pennington said he had as much respect for science as any man. He did not know much about science, but he knew some facts; that the grasshoppers had gone into districts this year where they never appeared before. His opinion was that they were like a cyclone—liable to strike almost anywhere. We had no patent right on them; we have them this year, and somebody else may have them next year. They said they would not hatch in a humid atmosphere; they said it was a scientific certainty; but they had had the most rain last year they ever had, and contrary to the scientific men's orders they hatched out more than they ever did before. He believed in science, but he wanted science to go hand in hand with common sense.

Prof. Riley remarked that he thought the discussion was somewhat unnecessary. The first wish expressed by Gov. Osborn was already carried out in the Committee's report, which distinctly stated that the pest is not native to Kansas, Nebraska, etc. He wanted truth to prevail, and not sectional feeling. He had no objection to stating the fact that all parts of the country were more or less subject to locust injuries, and had devoted a chapter in his 7th Report to show how great these sometimes had been in some of the New England States; but he wanted to have it borne in mind that the ravages of locusts east of the Mississippi were of different species from the one we are dealing with. Men write of *the* grasshopper, *the* locust, as though there was but one kind the country or the world over, and in publishing reports of grasshopper injuries from different parts of the country, without determining the species the reports referred to, the Department of Agriculture had done more harm than good. Science was the embodiment of knowledge classified, while the work of the Department in this line was the embodiment of ignorance unclassified. He agreed with Prof. Thomas that the pest we are considering would never do injury in Illinois, for past experience, as well as careful study of the subject, warranted the conclusion. Those not aware of the importance of specific distinction in science might ridicule the discriminations made by naturalists, but these were, nevertheless, very important. No one of any authority had claimed that the insect under discussion could not hatch in a humid atmosphere; but scientfic men had claimed, and with reason, that it could not perpetuate itself under such conditions. He saw no good in the attempt to make it appear that all parts of the country are threatened by the pest we are considering, as much as the country represented by the Conference, when there was really no foundation for it, and when the fact that the States east of the Mississippi find no reason to ask national aid would weaken our appeal to Congress, if those States were really as badly off as we are.

Prof. Thomas said that he had told the Governor of his State that they never would go there, and he was bound to stick to it.

Mr. Pusey thought we might defeat our purpose to secure Congressional aid by exhibiting too much sensitiveness as to the special theater of the grasshopper ravages. If it be true that Massachusetts, Pennsylvania, and other eastern States had been devastated, it was probably also true that they had not sought national aid; and we thus enabled them to say that as they had suffered temporarily and sought no aid, so our suffering was but temporary and we need no aid.

With reference to the fear expressed that immigration might be deterred by the dissemination of exaggerated reports, he thought we were likely to suffer from too little rather than too much public alarm upon this subject. There was an evident disposition to make light of the evil, and to treat the subject with ridicule, and he believed the ultimate good of all concerned demanded that the full truth in all its threatening proportions should be known.

Gov. Osborn said that next year when they were asking for help from this section of the country for his grasshoppered people then he would have to take a back seat. He then offered the following amendment which was adopted:

> We have no certainty that any particular State or county will be permanently afflicted by, or that any State or Territory will always be exempt from the ravages of locusts.

The report of the Committee having been further considered in detail, it was finally adopted as a whole, as herewith printed.

Gov. Osborn moved, and the motion was carried, that the committee appointed to prepare a pamphlet be instructed to embody a history of the ravages of grasshoppers in all sections of the United States.

[Gov. Pillsbury's paper was subsequently deemed a substantial compliance with this request].

On motion of Gov. Pennington, the President and Secretaries of the Conference were created a committee to prepare and publish the pamphlet called for in the resolutions.

Gov. Pennington said he understood that the President of the Conference had prepared a paper which embodied information upon many points under discussion, and he therefore called for the reading of it.

Gov. Pillsbury said that not anticipating what might be the order of proceedings, he had prepared a review of the subject, covering various periods of the past, and embracing the various remedies heretofore resorted to, but as much light had been thrown upon the subject by their discussions and otherwise, he feared the necessity for his article had been superseded, and he had accordingly decided not to read it as it was somewhat lengthy. At the request of the Conference, however, he read the paper, as follows:

Gentlemen: While it is not difficult to obtain information regarding the nature and habits of the locusts or grasshoppers, no particular methods or their extermination or for protection from their ravages have yet been found to any satisfactory extent. We can learn without much trouble of the great destruction caused by them in the different States, and especially in the Mississippi Valley, but the vital necessity of the hour—a necessity connected with the best interests of agriculture—is a speedy, practical remedy for the growing evil. The Bureau of Agriculture at Washington, established for the advancement of our great agricultural interests, is nearly silent in regard to locust or grasshopper devastations, the attention of the Department not having been directed to the investigation of the subject. Is there not a great fault that this Department has not given this question more attention? Surely it could not in any manner aid or advance the interests of agriculture better than by a thorough investigation of a subject so closely allied with the vital prosperity of the country. The fullest information on the subject is embodied in the reports of the regents of the Smithsonian Institution, to which I am indebted for many of the facts here given. In order to bring the subject readily before you I deem it proper to review briefly the destruction which has been made by the locusts in various countries, and at different periods of the past, together with some of the means which have been employed for defence against their inroads.

Perhaps the earliest recorded appearance of the grasshoppers upon the North American continent, was upon the lands of the Jesuit missionaries, in California, in the year 1722. They re-appeared there in 1746, and in 1753 and 1754, and again for three years successively, beginning with 1765. Captain Jonathan Carver, who explored the vast region of the extreme northwest in 1766, describes their appearance at that early day, adding that "they infest these parts and the interior colonies in large swarms and do a great deal of mischief."

The first record we find of the appearance of the locusts in the northwest during the present century is contained in Neill's history of Minnesota. It occurred in the Red River settlement in the years 1818 and 1819, and was an invasion in great force, causing much suffering in a young colony already struggling with the numberless hardships incident to early pioneer life. The account states that the grasshoppers came from the west one afternoon in the last week of July, 1818, ate everything green and deposited their eggs. The colonists were obliged to send to Prairie du Chien to obtain seed for their next crop. From 1820 to 1855 there seems to have been no marked locust invasion in the Mississippi Valley, excepting the ravages in Texas in 1845 and in 1849, and in Missouri in 1848. This long interval of quiet may perhaps be explained by the fact that within the interval severe visitations were felt in California in 1828, 1838 and 1846, and by the possible fact that the locusts may have crossed the Rocky Mountains, and made advances westward during those years. But it is plain from the words of Carver, already quoted, that the appearance of the locusts in the northwest was a thing of repeated occurrence before the time when he visited the country (1765), and it is more than probable that even portions of Minnesota were visited between 1819 and 1856.

The invasion of Minnesota in 1856–7 was confined mostly to a narrow belt upon the upper Mississippi valley, and though limited in area was exceedingly severe. The insects re-appeared in 1864 and 1865, chiefly in the northwestern portions of the State, doing but little damage except in a few localities. Their next appearance was in 1868, when they made a slight incursion. They appeared in limited numbers, doing little damage in 1871–2. But the period of the most prolonged and destructive visitation of the pests is that which began in 1873, and which continues to this date.

Missouri was severely ravaged by the insects along her western borders in 1866–7, fruit trees being much injured by them in 1867. In 1856 Utah, Texas and portions of Iowa and Minnesota suffered a destructive incursion from them. In 1866 they devastated portions of Iowa, Nebraska, Kansas, Missouri and Texas, the insects being so thick in some places as to obstruct railroad trains. They visited Utah in immense swarms in 1867 and were very destructive; and they re-appeared there in vast numbers in 1870. Colorado suffered terrible devastation from the insects in 1864, 1865, 1870, and at several periods since the last named year. Kansas and Nebraska were again visited by the grasshoppers in 1868, when the pests stripped corn fields bare and totally destroyed gardens and wheat fields.

The British Province of Manitoba was invaded by the insects as early as 1818, in which year and in the two years following, their ravages were extremely severe. In 1857 they re-appeared there and deposited their eggs, and in 1858 crops of all kinds were totally destroyed. The insects again appeared, in limited numbers, in 1864–5, and their devastation was so great in 1868 that a severe famine ensued, and aid was volunteered from Minnesota and granted by the Canadian government, in order to avert starvation. Fresh swarms invaded the Province in 1872 and laid their eggs, and more or less destruction has since ensued. No efforts appear to have been made to stay the ravages of the insects in that country.

In the vicinity of the Sacramento valley, California, in July, 1855, the locusts made their appearance in great numbers. The air for three days, at an elevation of from twenty to two hundred feet, was literally thick with them, resembling a dense snow-storm. Great numbers fell upon the streets of Sacramento, and the city seemed actually taken by storm. They immediately commenced the wholesale destruction of every green thing in the neighborhood. In the Sacramento valley whole orchards, vineyards and gardens have been consumed by them. Entire fields of grain and other crops and vegetables were eaten up in the course of a single day. In some portions of the valley they annoyed the passengers and horses of the public stages to such an extent as to cause the greatest inconvenience, and in some instances so as to positively endanger human life.

They even consumed the leaves and bark of the alder tree, and the young leaves and bark of the small branches of the cottonwood and willow, and even the soft green parts of the bullrushes, and in some parts of the valley they ate through gauze and textile coverings of all kinds, which had been used to shelter animals and plants from their attack. In the same year and the year following, they visited Oregon, Utah and Texas in great numbers, destroying every green thing in their way, and fully one-half of the entire crops of all kinds. In 1856 Kansas, Nebraska, Iowa, Minnesota, and other States were visited. Their ravages were fully as destructive as in California the previous year. The principal mode for the destruction of the locust has been the burning of the prairies. The Indians take the locusts, sweeping them into holes or pits, or surrounding them by fire and driving them into the centre, thus roasting them, and afterward using them for food. As early as the years 1749, 1754 and 1756, the locusts made their appearance in Maine (see Williams' History of Maine), and devoured almost every green thing, even to potato tops. So great was the alarm occasioned among the people that days of fasting and prayer were appointed on account of the threatened calamity. In the year 1826 the locusts made their appearance in New Hampshire by millions, and were fully as destructive as in Maine. They destroyed the entire crops of the State or nearly so. Late in the autumn a heavy flood came, after which cold weather set in and destroyed the eggs which had been deposited during the summer. So abundant were these insects that Arnold Thompson, of Merrimac county, succeeded in catching in a single evening, between the hours of 8 and 12, five bushels and three pecks, by means of a sack fastened to a cross-pole.

In Dwight's travels through New England and New York in the years 1797 and 1798, there is an account of the locusts in Vermont, Massachusetts, and New Hampshire; and the insects in these States were, if possible, even more destructive. They devoured clover, maize, tobacco plants, burdock, all vegetables, and even garments of men busy in the field. They also devoured the loose particles of saw dust left on freshly sawed boards. In 1838 Baltimore was infested by these insects. The locusts were so thick and destructive in gardens and grounds that negroes were employed to drive them from the fields and gardens with rods, and in this way the insects were repeatedly whipped out of the grounds, leaping and flying before the line of castigators like flocks of fowls. These were red-legged locusts.

From Gray's account of the West India Islands, locusts there are fully as destructive as in the United States. Wherever they alighted, either upon trees, corn, or green fruits nothing was expected but ruin and barrenness. Efforts were made on the approach of the insects to frighten them away by the blowing of trumpets and other instruments; and to destroy them trenches were dug, and the young driven into them. Mexico has often been infested by locusts, and their ravages have caused in some localities severe famine. They often devastate various portions of Central America, and, according to accounts given by E. G. Squire, are of the same species as those in the United States. At intervals they afflict the entire country. The means of defense there resorted to are lighting of fires, and shouting and waving of branches to arrest the attack.

In Palestine, the inhabitants, at the approach of the locusts, endeavor to drive them away with smoke from burning piles of wood and with beating of sticks and rods upon the ground, and of metal kettles, with musical instruments and shouting, etc.

In Morocco, where people have been acquainted with locusts, and subjected to their ravages some portion of the year, time without date, the people undertake to destroy them with wet and dry ditches, into which the young insects are driven and destroyed; and also by driving horses, cattle, and sheep over the ground infested by them.

Long ropes have been used. These were drawn upon the ground as low as possible by two men having hold, one at each end, who at the same time made noise by brawling and beating, endeavoring to drive them into trenches dug across, or to a cloth stretched out upon the ground and drawn up to a ridge, where they were trampled upon and crushed by rollers. In the province of New Russia the most effectual method for destroying locusts is by driving the young into ditches dug two or three feet deep. The Russian government has decreed that a sum equal to ten cents per pint shall be paid for the locust eggs. The locusts in Russia are gathered at night by the aid of a sieve, and thrown into bags and so destroyed.

In some countries the experiment of watering the fields with lime water and lye to destroy the eggs of the locust, has proved impracticable, as the eggs can hardly be reached to any extent by this means.

In Greece, each inhabitant is required to take part in their destruction three times a year, first, in destroying their eggs, next in destroying the young larvæ, and lastly in destroying the adult locust. In China and the Roman empire, and in many parts of Turkey, the rural authorities are required to have the inhabitants attend to the destruction of the locusts, in order to prevent their becoming a public scourge. The means for their destruction were sheets spread out and the young locusts driven on them and put into bags and destroyed; also brooms and shovels were used for their destruction. A reward is paid for the destruction of the insects and their eggs by those governments. In France, when the locusts make their appearance, all the people who are able go to the rescue—men, women, and children—and use whatever means may be at hand. From the earliest times, by regulation of the government, a common price has been paid for the locusts collected and their eggs. The reward of one-half franc is paid for two pounds of eggs, and one-quarter franc for the same weight of the insects. Twenty-five thousand francs have been paid in one year for collecting 295,000 pounds of eggs and insects. In Italy, Hungary, and Spain, the government pay rewards for the destruction of locusts or their eggs.

In Spain, they formerly swept the young locust into large heaps with long-brooms and burned them. Eighteen thousand bushels were collected in three weeks by three thousand men. It is certain that many kinds of birds are destructive to the locust and are his worst enemy. A bird in India, termed the grakle, is a great consumer of the locust and its eggs. The grakle is similar to our California chenate or black-bird. The inhabitants of India have killed the grakle to almost his extermination because of his depredations upon the young crops; but when this has been effected a great increase has occurred of destructive insects and especially the locusts. Some of the eggs of the locust being accidentally introduced into the French island of

Bourbon, they multiplied so as to threaten the devastation of the country. The government, learning the great services of the grakle in India, had a number of pairs imported and distributed over the islands under the government's charge. They bred very fast, and in a few years the locusts were exterminated. The grakle then began to dig the newly sown fields in search of eggs, when the colonists, concluding that they were devouring the seed, were alarmed, and got them exterminated by the government. In a few years they perceived their error, for the locusts again commenced their ravages. Upon this, the government procured a new supply of grakles, and the birds cleared the island of locusts.

There is a species of bird found in immense numbers in Russia, Poland, and Lower Egypt, and on the shores of the Mediterranean, called the rose-colored black-bird, that feeds on locusts, and their eggs and larvæ. It devours incredible numbers in a day. The red-winged starling of the southern Atlantic States, described by Alexander Wilson, is another great enemy to the locust. Mr. Wilson estimates that two millions of the starling will consume in three weeks the enormous amount of sixteen thousand two hundred millions of the eggs and larvæ of grasshoppers.

The large number of birds found in our several States are intended as positive blessings to the people; and there is no doubt that suitable laws should be passed by all States, and especially those which are ravaged by locusts or grasshoppers, for the protection of birds, especially the starling, blackbird, lark, crow, jackdaw, stork; and that the rose-colored starling and grakle should be introduced into the United States. These birds are a very destructive enemy to the locusts. They pursue them at night when they alight on the ground. It should be regarded as a crime to shoot or catch any birds which show themselves useful to the inhabitants. In Egypt, the ibex was considered sacred, because it destroyed reptiles and insects, especially the locust. France places her chief reliance for the destruction of the locusts upon birds.

I shall not attempt any details of the prolonged series of visitations of these insects, from which so many of the States and Territories are now suffering. Since 1873, few portions of the vast country lying between the Mississippi river and the Rocky mountains, have long been exempt from their ravages. Most of you are doubtless familiar with the sad experience of many localities in your several States, where the people have suffered continuously to the last extremity of endurance. In my own State, the ravages have thus far been confined to a comparatively small belt along our western and northern borders, but within this area many localities have suffered an almost total loss of crops for four years in succession; and with the people there the question is fast assuming the vital alternative of exterminating the pests, or of being exterminated by them. During the present year, while the total loss has been little or no greater than in prior seasons, and less complete destruction has occurred in any single locality, the insects have laid their eggs in sections not heretofore visited by them, creating an apprehension for the future, such as has never before been experienced.

It is a singular fact, that although the grasshoppers or locusts have infested various portions of this country, more or less, nearly every season for the past one hundred years, few of our observing writers or scientists have made more than a passing notice of an insect which has caused this country so much distress by its terrible ravages, except Prof. Riley, State Entomologist of Missouri, whose valuable reports have thrown much light upon the subject, and perhaps a few others. The nature and habits of the locust should be diligently observed by the cultivators of the soil, and by the scientific men of this country. The general government should employ the ablest naturalists in America to study and compile for public use the most searching and complete investigations into their habits, etc., and the best methods of checking their increase and thwarting their ravages. The most illustrious nations of the world have not disdained to devote their time and means to the destruction of this pernicious insect; and it surely becomes our nation, which prides itself upon its practical sagacity, to give timely heed to a problem upon the solution of which depends so largely the primary sources of its prosperity.

Gov. Osborn, strongly commending the paper just read by Gov. Pillsbury, moved that it be accepted and formally incorporated in the published proceedings, and that the thanks of the Conference be tendered the author for the same. The motion was carried.

Governors Hardin, Kirkwood, and Pillsbury were, on motion of Gov. Pennington, constituted a committee to draft the proposed memorial to Congress, to be signed by the members of the Conference.

On motion of Gov. Osborn 10,000 copies of the proposed pamphlet of proceedings were ordered to be printed for distribution, the expense of the same to be borne equally by the several States represented.

The question of the expense incurred by the Conference for the use of the hotel parlors being under consideration, Gov. Garber stated that the same had been provided for, whereupon the thanks of the Conference were voted for the accommodations furnished.

Prof. Riley offered the following, which was adopted:

> *Resolved*, That in the event of the appointment of a national commission for the investigation of the locust problem, each of the States and Territories interested be urged to appoint a commissioner or commissioners to work in such States and Territories, and to co-operate with the national commission in accumulating facts and experiments.

The Committee on Resolutions having been unable, from want of time, to reach the resolution of Gov. Pennington, and the petitions from the Synod of Minnesota and from the Dakota Mission and Conference of the Dakota Indian Churches, in relation to the appointment of a day for fasting and prayer, reported the same back to the Conference, which thereupon ordered the papers to be read.

The resolution referred to, offered by Gov. Pennington, having undergone a slight amendment, was read as follows:

> WHEREAS, the scourge of the grasshopper or locust has become so

alarming during the last few years as to seriously threaten the prosperity of many of the States and Territories; and

WHEREAS. They have appeared in many localities in such force as to utterly defy the ingenuity of man, without the blessing of God, to avert the danger and protect the growing crops; and

WHEREAS, While we have a never-failing faith in the goodness and wisdom of that all-seeing and ever merciful God, who controls the early and the latter rains, and whose merciful providence gives us seed time and harvest;

Be it therefore Resolved, That we respectfully but earnestly urge that all our people in the States and Territories afflicted with the locusts, of all denominations and sects, offer up special prayers in their respective churches for deliverance from this great enemy.

Whereupon the same was adopted.

The Conference then adjourned, *sine die.*

JOHN S. PILLSBURY,
PRESIDENT.

Prof. C. V. RILEY,
PENNOCK PUSEY,
Secretaries.

MEMORIAL TO CONGRESS.

To the Honorable the Senate and House of Representatives, in Congress assembled:

The Memorial of the undersigned, Executives of various States and Territories, together with scientific men interested in the subject, assembled to consult upon practical and concerted means for the arrest of the prevalent locust or grasshopper plague, respectfully represents that various portions of the country have been devastated by the insects known as locusts or grasshoppers, at divers periods of the past, for one hundred and fifty years; that during the past twenty years the number and ravages of these insects have increased with alarming rapidity; that many of the settlers in the Western States and Territories have suffered a total loss of crops from the ravages of one species (the Rocky Mountain locust) for four years in succession, and are in consequence reduced to great poverty and distress; that these insects, as history shows, confine their devastation to no one State or section of the country, but have overrun no less than sixteen States and Territories during the year 1876; that by their swift migrations from State to State destroying millions of dollars of the farmers' hard earnings, crippling the progress of the border States and retarding the settlement of the Territories, these destructive insects have become a national plague; and it is our profound conviction that an evil which, by impairing the prosperity of agriculture threatens the source of productive industry, deserves the prompt and thorough consideration of the national government.

Your Memorialists therefore respectfully ask:

First, That a commission be appointed by your honorable body at the earliest practicable moment, to consist of three entomologists and two practical men of experience with the locusts, to be appointed by the chief of the geological and geographical survey of the territories, and approved by the Secretary of the Interior, the duty of which commission it shall be to examine into the history, nature and habits of the insects, and to suggest such means of destroying them, and such remedies against their ravages, by the offer of bounties for the destruction of their eggs or otherwise, as their investigations shall prove most practicable. And for this purpose that the sum of $25,000 be added to that part of the Sundry Civil Appropriation Bill providing for said survey of the Territories, in order to pay the salaries and expenses of such commission.

Second, That the Signal Service be authorized and required to take regular observations of the movements of the insects, of the time, direction, and extent of their flights, the time of the hatching and departure of the young locusts, and other particulars concerning them; and that the information thus obtained of the appearance and progress of the swarms, and such other observations as may prove of practical service, be published with the daily weather reports; and that Gen, Meyer be provided with such additional means and assistance as shall be adequate to the demands of such enlarged operations.

Your memorialists ask this in view of the ravages of the past, and with grave apprehensions for the future, arising from the increased numbers of the pests and the enlarged area in which they have deposited their eggs. They believe that by reason of the winged and evasive movements of the locusts, the limitless field of their operations, and the predatory and mysterious character of their incursions, as well as their countless numbers, these insects constitute an enemy too formidable to be successfully encquntered by any single State or community; and they are fully persuaded that the evil has swollen into a scourge of national dimensions, requiring the interposition of the general government. Your memorialists moreover believe, that if il is within your legitimate province to improve our rivers and interior harbors, in order to facilitate the movement of crops, the rescue of those crops from the rapacity of a common enemy cannot be less an object of your rightfu care; and that the same public policy which encourages internal commerce equally justifies the preservation of those important agricultural products without which there can be no commerce.

All of which is respectfully submitted, and your favorable action thereon urgently solicited. And your petitioners will ever pray, etc.

C. H. HARDIN, Governor of Missouri.
Prof. C. V. RILEY, State Entomologist of Missouri.
JOHN L. BEVERIDGE. Governor of Illinois.
Prof. CYRUS THOMAS, State Entomologist of Illinois
SAMUEL J. KIRKWOOD, Governor of Iowa.
THOMAS A. OSBORN, Governor of Kansas.
SILAS GARBER, Governor of Nebraska.
ROBT. W. FURNAS, Ex-Governor of Nebraska.
ALVIN SAUNDERS, Ex-Governor of Nebraska.
Prof. C. D. WILBER, Nebraska.
Prof. A. D. WILLIAMS, Nebraska.
JOHN S. PILLSBURY, Governor of Minnesota
PENNOCK PUSEY, Minnesota.
Prof. ALLEN WHITMAN, Minnesota.
JOHN L. PENNINGTON, Governor of Dakota Territory.

LETTER TO THE PRESIDENT.

STATE OF MINNESOTA,
EXECUTIVE DEPARTMENT, SAINT PAUL, NOV. 6, 1876.

TO HIS EXCELLENCY ULYSSES S. GRANT,
President of the United States.

SIR: The undersigned has the honor to state that a conference of the Governors of certain States and Territories, and others interested in the subject, was called and held at the city of Omaha, State of Nebraska, on the 25th and 26th days of October last, for consultation upon the locust or grasshopper question, and with the purpose of securing comprehensive and concerted action for the arrest of an evil of growing magnitude; that such conference comprised the following named official and scientific gentlemen:

Gov. C. H. HARDIN, of Missouri.
Prof. C. V. RILEY; State Entomologist of Missouri.
Prof. CYRUS THOMAS, State Entomologist of Illinois.
Gov. SAMUEL J. KIRKWOOD, of Iowa.
Gov. THOMAS A. OSBORN, of Kansas.
Gov. SILAS GARBER, of Nebraska.
Ex-Gov. R. W. FURNAS, of Nebraska.
Ex-Gov. ALVIN SAUNDERS, of Nebraska.
Prof. C. D. WILBER, of Nebraska.
Prof. A. D. WILLIAMS, of Nebraska.
Hon. GEO. W. FROST, of Nebraska.
Gov. JOHN L. PENNINGTON, of Dakota Territory.
Gov. JOHN S. PILLSBURY, of Minnesota.
PENNOCK PUSEY, Private Secretary to Gov. Pillsbury.
Prof. ALLEN WHITMAN, of Minnesota.

And that the Executives of most of the other States and Territories west of the Mississippi river expressed their desire to be present and their approval of the movement.

That among other proceedings of such Conference was the adoption of the following resolution:

"*Resolved*, That the President of the Conference be requested to draw up and present to the President of the United States a letter, setting forth the urgent necessity for some action on the part of the general Government in behalf of the sections ravaged, in reference to the invasions of, and destruction occasioned by, the grasshoppers."

In compliance with the request embraced in such resolution, the undersigned begs leave to state that at various periods for more than a century past, many parts of the country have sustained great loss of agricultural products from the ravages of locusts or grasshoppers; that these destructive insects have increased, and their incursions multiplied with alarming rapidity during the past twenty years; that large areas along our extended frontier have been laid waste, millions of property destroyed, and thousands of families reduced to great destitution by the total and successive destruction of their crops; that the agricultural prosperity of the country has thus been impaired, and the settlement of the Territories greatly retarded; that past experience forbids the hope that any portion of the country may be deemed exempt from the inroads of these insects; that they nvaded no less than sixteen States and Territories the present season, and that they have deposited their eggs in a vast extent of territory not heretofore subjected to their ravages, creating grave apprehensions for the future.

An evil which is thus rapidly enlarging to national dimensions, it is believed should receive the prompt attention of the national government. It is indeed manifest that a vigorous effort for the arrest of a scourge so far beyond individual control, cannot longer be wisely or safely deferred; and, on behalf of the Conference, I respectfully and urgently request that you will commend the subject in your next annual message, or other suitable manner, to the favorable action of Congress, and ask of that body the appointment of a commission for the thorough investigation of the subject, together with such provision for the correction or mitigation of the evil as such investigation may suggest. The Conference moreover ask that the Signal Service Bureau be authorized and required to make and publish, with the regular weather reports, such observations of the egg deposits, periods of hatching, and movements of the insects, as will aid to guard against their ravages.

The power of sudden migration possessed by the locusts, their vast and increasing numbers, the boundless scope of their operations, their unanticipated movements, and their appalling rapacity, combine to render them an enemy which may well defy the opposition of any single community or section, and which clearly demands for its overthrow the strong and extended interposition of the general government.

In conclusion allow me, on behalf of the Conference, to express the conviction that the functions of government can in no direction receive more beneficent or legitimate exercise than in a vigorous effort to guard the prime sources of the national prosperity.

On behalf of the Conference,

I have the honor to be,

Most respectfully, your obedient servant,

JOHN S. PILLSBURY,

Pres. of the Conference.

PRACTICAL CONSIDERATIONS

AND

SUGGESTIONS

FOR THE

REPRESSION OF THE ROCKY MOUNTAIN LOCUST

(*Caloptenus spretus*, Thomas.)

[The Governors of Minnesota, Illinois, Iowa, Kansas, Nebraska, Missouri, and Dakota Territory, having met in conference for the purpose of consulting in reference to the locusts, and having exchanged opinions with one another, and with men of long western experience, as well as scientific men; and having discussed the facts gathered from all parts of the west visited by these pests, and the various remedies tried and suggested, feel fully warranted in making the following statements to the people of their respective States and Territories:

1. That, although it is highly probable that locusts will occasionally visit portions of our territory, unless the national government finds some means of destroying them in their native haunts, yet it is evident that the late series of visitations is unprecedented, and will not be likely to recur for some years to come.

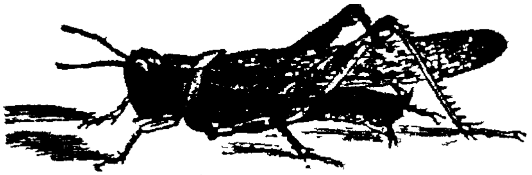
2. It is well known that in most of the States, and especially in the Eastern States along mountain ranges, locusts have repeatedly ravaged the country during the past century, and often to an extent compared to which our own losses sink into insignificance. We have also no certainty that any particular section of country will be permanently afflicted by, or that any State or Territory will be always exempt from, the injury of locusts.

3. That we have prepared an appeal to Congress on your behalf, requesting it to order a thorough investigation of this subject, to see if it is possible to exterminate the pest, and feel confident that the request will be granted.

4. That our consultation with each other and with those who have tested the matter has resulted in the firm conviction that by proper efforts, concerted action, and a vigorous and determined warfare against them, the young grasshoppers, which may be hatched out next year, or any subsequent year, can be successfully fought and our crops saved; that we are not without remedy, but we may protect our crops against them if we will but make use of the means within our reach. We say this not simply for the purpose of encouraging our agriculturists, although this is one great object we have in view, but also because we are thoroughly satisfied of its truth. And in order to aid you as far as possible, we have caused to be drawn up the following statement of the methods which may be adopted to destroy them, and to protect your crops against them.]

As the past history, power for harm, and general characteristics of the insect have been duly brought out in the foregoing Proceedings of the Conference, we deem it necessary in this second part of the pamphlet to give only, and in the briefest manner, such facts regarding the natural history of the enemy as bear on the practical considerations which follow, and more particularly on the work recommended to be done the coming spring.

[FIG. 1.]

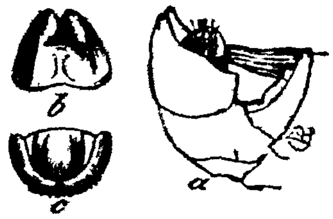


ROCKY MOUNTAIN LOCUST.

CHARACTERS OF THE SPECIES.

Though often confounded with other species, the Rocky Mountain Locust may be recognized by the following characters: It measures on an average about 1¼ inches from the head to the tip of the closed wings, and the wings extend about one-third their length beyond the tip of the abdomen. The color is variable, but the more common specimens are yellowish white beneath; glaucous or cabbage blue across the breast and about the mouth parts; pale bluish, often with shades of purple, on the sides of the head and thorax and on the front of the face; olive-brown on the top of the head and thorax; pale beneath, more or less bluish above and marked with black, especially toward base, on the abdomen. The front wings have the ground-color pale grayish-yellow, inclining to green, and their spots and veins brown; the hind wings, except a yellowish or brownish shade at apex and along the front edge and a green tint at base, are transparent and colorless with the veins brown. The front and middle legs are yellowish.

[FIG 2.]



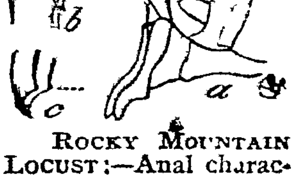
ROCKY MOUNTAIN LOCUST:—Anal characters of male; *a*, side view; *b*, *c*. hind and top views, of tip.

The hind legs have the thighs striped with pale glaucous and reddish on the outside and upper half of inside, with four broad black or dusky marks on the upper edge, the terminal one extending beneath around the knee. The shanks are coral-red, with black spines; the feet somewhat paler, with black claws; antennæ pale yellow; palpi tipped with black. In the dead specimens all these colors become more dingy and yellow. It very closely resembles, and is often confounded with, the Red-legged Locust (*Caloptenus femur-rubrum*, De Geer), a species common to the whole middle portion of the continent from the Atlantic to the Rocky Mountains, which, though capable of short flights, never commits the same havoc. This last is, on an average, smaller, darker, with shorter and less conspicuously spotted wings (seldom extending more than one-sixth of their length beyond the tip of the abdomen), and the last abdominal joint of the male is bluntly cut off at the top, and not tapering and notched as in the *spretus* (Fig. 2).

HOW THE EGGS ARE LAID.

The female, when about to lay her eggs, forces a hole in the ground by means of the two pairs of horny valves which open and shut at the tip of her abdomen, and which, from their peculiar structure, are admirably fitted for the purpose. The eggs are voided in a pale, glistening and glutinous fluid, which holds them together and binds them into a long cylindrical pod, covered with particles of earth which adhere to it. When fresh the whole mass is soft and moist, but it soon acquires a firmer consistency. It is often as long as the abdomen, and usually lies in a curved or slanting position. It is never placed much more than an inch below the surface, except where some vegetable root has been followed down and devoured, and the insect leaves her eggs before emerging; in this way the mass is sometimes placed a foot below the surface The eggs which compose this mass are laid side by side, to the number of from 20 to 50, according to the size of the mass. They are 0.15 to 0.20 inch long, one-fourth as wide, slightly curved, of a pale yellow color, and rather larger at the anterior than the posterior end. As the hatching period approaches, they become more plump and pale, and the embryo, with its dark eyes, is visible through the shell which is now somewhat transparent. The

[FIG. 3.]



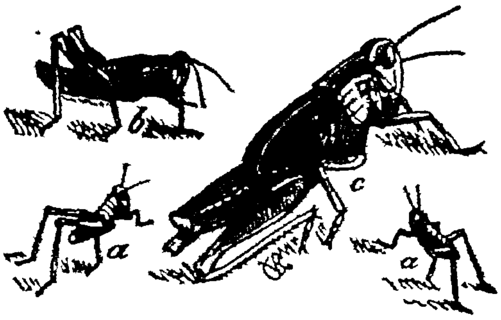
ROCKY MOUNTAIN LOCUST:—Anal character of female. showing horny valves.

opening to this egg-mass is covered up by the mother, but the newly hatched insect has no difficulty in escaping.

TRANSFORMATIONS.

When first hatched the little 'hopper is quite pale, but soon becomes mottled with gray and brown. In escaping from the egg it is at first covered with a delicate white pellicle which has to be cast off before there can be freedom of motion; so that the insect may be said to molt as soon as it is born. Except in having a narrower pro-thorax, sloping roof-fashion to a median ridge, and in lacking wings, the young locust scarcely differs in structure from its parent; and the perfect, winged form is gradually assumed through a series of four molts, during the first three of which the wing-pads become larger, and during the last, from the pupa (Fig. 4, *c*,) to the perfect state, the thorax becomes flattened, the wings are acquired and the insect ceases to grow and is ready to procreate. The time required from hatching till the wings are obtained, average from six weeks to two months.

[Fig. 4.]



Rocky Mountain Locust.—*a*, *a* newly hatched larvæ; *b*, full grown larva; *c*, pupa.

HABITS OF THE UNFLEDGED LOCUSTS.

In latitude 39° and in ordinary seasons the great bulk of the young hatch out about the middle of April, but others continue to hatch even up to the time when the first hatched get wings, so that up to the first of June they are met with of all sizes from the newly hatched to the winged. The period is earlier as we go South, and later as we go North. So long as provision suffices for them on their hatching grounds the young remain almost stationary, and create but little general apprehension. As soon, however, as the supply of food in these situations is exhausted, they commence to migrate, frequently in a body a mile wide, devouring as they advance all the grass, grain and garden truck in their path. The migrating propensity is not developed until after the first molt. Up so that time they are content to huddle in warm places, and live for the most part on weeds, and especially on the common dog fennel or Mayweed (*Maruta*).

The young locusts display gregarious instincts from the start, and congregate in immense numbers in warm and sunny places. They thus often blacken the sides of houses or the sides of hills. They remain thus huddled together during cold, damp weather. When not traveling, and when food is abundant, or during bad, rainy weather, they are fond of congregating on fences, buildings, trees, or anything removed from the moist ground. They also prefer to get into such positions as to undergo their different molts.

Their power for injury increases with their growth. At first devouring the vegetation in particular fields and patches in the vicinity of their birth-places, they gradually widen the area of their devastation, until at last they devour every green thing over extensive districts. Whenever they have thus devastated a country they are forced to feed upon one another, and perish in immense numbers from debility and starvation. Whenever timber is accessible they collect in it, and after cleaning out the underbrush, feed upon the dead leaves and bark. A few succeed in climbing up into the rougher-barked trees, where they feed upon the foliage, and it is amusing to see with what avidity the famished individuals below scramble for any fallen leaf that the more fortunate mounted ones may chance to sever. This increase in destructiveness continues until the bulk of the locusts have undergone their larval molts and attained the *pupa* state. The *pupa*, being brighter colored, with more orange than the larva, the insects now look, as they congregate, like swarms of bees. From this time on they begin to decrease in numbers, though retaining their ravenous propensities. They die rapidly from disease and from the attacks of natural enemies, while a large number fall a prey, while in the helpless condition of molting, to the cannibalistic proclivities of their own kind. Those that acquire wings rise in the air during the warmer parts of the day and wend their way as far as the wind will permit toward their native home in the Northwest. They mostly carry with them the germs of disease or are parasitized, and wherever they settle do comparatively little damage.

DIRECTIONS IN WHICH THE YOUNG LOCUSTS TRAVEL.

The young insects move, as a rule, during the warmer hours of the day only, feeding, if hungry, by the way; but generally marching in a given direction until toward evening. They travel in schools or armies, in no particular direction, but purely in search of food—the same school often pursuing a different course one day to that pursued the day previous. On this point the experience of 1875 is conclusive, though the bulk of the testimony as to their actions, when hatching out in States to the north and west, is to the effect that the prevailing direction taken is south or southeast. A person traveling along a road may often see them marching in one direction to the left and in the opposite direction to the right.

RATE AT WHICH THE YOUNG TRAVEL.

When about half grown they seldom move at a greater rate than three yards a minute, even when at their greatest speed over a tolerably smooth and level road, and not halting to feed. They walk three-fourths this distance and hop the rest. Two consecutive hops are seldom taken, and any individual one may be run down and fatigued by obliging it to hop ten or twelve times without a rest.

THEY REACH BUT A FEW MILES EAST OF WHERE THEY HATCH

At the rate at which they travel, as just described, they could not extend many miles, even if they continued to travel in one direction from the time of hatching until maturity. They travel only during the hotter portions of the day, six hours on an average; and their unfledged existence terminates in from six to eight, say seven weeks. It is very easy to calculate from these facts that if they continued in one direction from the time they hatch until they acquire wings, they would not extend thirty miles. In reality, however, they do not travel every day, and where food is abundant they scarcely travel at all. Moreover, as just shown, they do not commence traveling till after the first molt, and they do not go continually in a particularly eastern direction, but in all directions.

REMEDIES AND PREVENTIVE MEASURES.

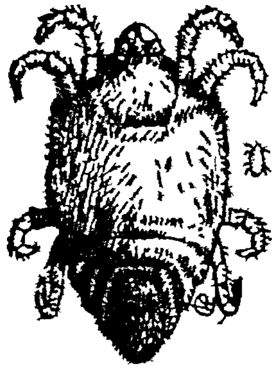
The means to be employed against the ravages of this insect in the more fertile country subject to its occasional visitations, but in which it is not indigenous, may be classed under five heads: 1. Natural agencies; 2. Artificial means of destroying the egg: 3. Such means of destroying the unfledged young; 4. Remedies against the mature or winged insects; 5. Prevention.

1. Natural Agencies.—It is fortunate for man that, as in the case of most noxious insects, this locust is not without its numerous enemies. Chickens, turkeys and hogs devour it in immense quantities, and thrive during years of locust invasion, or whenever these insects abound. Prairie chickens and quails devour them with avidity, and even hunt for their eggs; swallows and blackbirds pursue them unrelentingly; the little snow birds devour great quantities of eggs when these are brought to the surface by the freezing and thawing of the ground; and the same may be said of almost all birds inhabiting the Western country in winter.

The good offices of birds were everywhere noticed in 1875, and Mr. Wise, of the Minnesota Commission, is of the opinion that the blackbirds and prairie chickens destroyed a large portion of the eggs laid in that State in 1875, scratching for them after the fashion of hens. Prof. F. H. Snow, of Lawrence, Kansas, found the young locusts in the gizzards of the Red-headed Woodpecker (*Melanerpes erythrocephalus*), Yellow-billed Cuckoo (*Coccyzus Americanus*), Cat-bird (*Mimus Carolinensis*), Red-eyed Vireo (*Vireo olivaceus*), Great-crested Flycatcher (*Myiarchus crinitus*), and Crow Blackbird (*Quiscalus versicolor*), species that had not been noticed to feed on them before. The Shrike, or Butcher-bird, impales them on to thorns and other pointed substances; and a number of other birds, as well as reptiles, *e. g.*, toads, frogs and snakes feed upon them. The full grown insects are not unfrequently infested with a long, thread-like worm, well known by the popular name of "hair-worm," and erroneously supposed by many good people to be animated horse-hairs. Specimens are often taken which are thrice as long as the locust they came from, and belonging to both the genera *Gordius* and *Mermis*. But by far the most effective helps in weakening the vast armies of locusts are the parasitic and predaceous insects, albeit their work is perhaps less noticeable and less appreciated. Passing over the few, like certain species of Digger Wasps, belonging to the genus *Scolia*, which occasionally bury a few specimens as provision for their young; the ferocious Asilus flies, which occasionally pounce upon a specimen and suck out its juices, and the omnivorous ant, which sometimes feeds on the eggs, and on the weak, sickly and disabled 'hoppers, we will treat more particularly of those parasitic and predaceous species which render effective service to man in destroying the locust. For practical purposes these may be divided into those which attack the eggs and those which attack the active locust.

Insects which attack the Eggs.—THE SILKY MITE (*Trombidium sericeum*, Say, Fig. 5, the natural size shown at the side). This is a small scarlet animal about two lines long, which has for some time been known to attack the eggs, and has particularly done good service in the more Northern States. In parts of Minnesota it has the present year, in many places, reduced the eggs to a powder, and the ground has been alive with the little red, active bodies.

[FIG. 5.]



SILKY MITE:—Natural size at side.

THE ANTHOMYIA EGG PARASITE (*Anthomyia calopteni*, Riley.)—Up to the present year the Silky Mite was the only parasite that was known to attack the eggs of our locust, though a small Chalcid-fly had been bred by Mr. S. H. Scudder, from those of the Carolina Locust, a large species with blue and black hind wings; and two Ichneumon-flies were known to attack locust eggs in Europe. The present year five new insect enemies have been found attacking these eggs almost everywhere throughout the infested country. That under consideration, which may be known as the Anthomyia Egg-parasite, is quite common and has been found in Minnesota, Iowa, Nebraska, various parts of Kansas, Missouri, and even Texas. It has destroyed in many instances, as many as ten per cent. of them.

This good little friend, which has simultaneously prevailed over so large an extent of country, is a small white maggot, of the same general form of the common meat maggots or "gentiles," but measuring when full grown and extended not quite ¼ of an inch in length. The head, with some of the anterior joints of the body, tapers and is retractile, and the jaws consist of two small hooks joined to a V-shaped, black, horny piece which plays beneath the transparent skin as it is retracted or extended. The hind or tail end is squarely docked off, and contains two small yellowish-brown, eye-like spots, which are the principle spiracles or breathing pores.

These small maggots are found in the locust egg-pods, either singly or in varying numbers, there sometimes being a dozen packed together in the same pod. They exhaust the juices of the eggs and leave nothing but the dry and discolored shells, and where they are not numerous enough to destroy all the eggs in the pod, their work, in breaking open a few, often causes all the others to rot.

When fed to repletion this maggot contracts to a little cylindrical, yellowish-brown pupa, about half the length of the outstretched and full-grown larva, and rounded at both ends. From this pupa, in the course of a week in warm weather, and longer as the weather is colder, there issues a small grayish, two-winged fly, about ⅕ of an inch long, the wings expanding about ⅓ of an inch, and in general appearance resembling a diminutive house-fly. It belongs to the genus *Anthomyia*, and Prof. Riley will describe it as *Anthomyia calopteni*.

THE COMMON FLESH-FLY.—More rarely there will be found in the locust egg-pods a somewhat larger maggot than the preceding. It contracts to a darker pupa which is not similiarly rounded at each end, but has the hind end truncate, and the front end tapering. This is the larva of the common flesh-fly (*Sarcophaga carnaria*, Fig. 7, *a*), which also attacks the perfect locust. This larger maggot also sucks the eggs, but the parent fly is probably attracted to those only which are addled, as the pods in which I have found it have very generally been in a fluid state of decay.

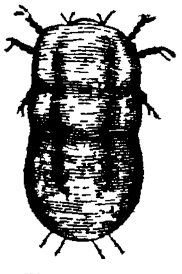
UNDETERMINED SPECIES —Next to the Anthomyia Egg-parasite, in importance, is a much larger, more sluggish, yellowish grub, measuring about ½ an inch when extended, which is found within or beneath the locust eggs, lying in a curved position, the body being bent so that the head and tail nearly touch each other. It is a smooth grub, with a very small brown flattened head, with the joints near the head swollen and the hind end tapering, and with deep, translucent sutures beneath the joints, which sutures show certain vinous marks and mottlings, especially along the middle of the back. It exhausts the eggs, and leaves nothing but the shrunken and discolored shells. It has not yet been reared to the perfect state, but from the structure of its mouth it is evidently Hymenopterous, and will produce without much doubt, some Ichneumon-fly. It has been found in Minnesota, Iowa, Kansas and Missouri, and has destroyed about one per cent. of the eggs.

Besides the three preceding species which have been found destroying the eggs the present year, and which from their being generally found within the egg-pod, may be called parasitic, though they are not strictly so we have also found the larvæ of two species of Ground-beetles (*Carabidæ*) attacking said eggs. One pale species, belonging to the genus *Harpalus*, is more particularly common and busy in the good work.

Insects which destroy the active Locust.—The young locusts are pursued by many predacious beetles, and several species of predatory soldier-bugs attack them, while the full-grown insects are subject to the attacks of the following parasites:

THE LOCUST MITE (*Astoma gryllaria*, LeBaron, Fig 6).—This is at minute mite, about the size of a small pinhead. Almost every one who has paid any attention to the locusts must have noticed that they are often more or less covered, especially around the base of the wings, with these small, red mites. These have but six legs which, though easily visible when the animal first attaches itself, become more or less obsolete and invisible as it swells and enlarges: a careful examination, however, will generally reveal them at the anterior end of the body. The mite, therefore, more often presents to the ordinary observer a bright red, swollen, ovoid body, so immovable and firmly attached by its minute jaws, that those who are not aware of its nature might easily be led into believing it a natural growth or excrescence. In fact, it attacks the locust precisely as the different wood-ticks attack man and the lower mammals.

[FIG. 6]

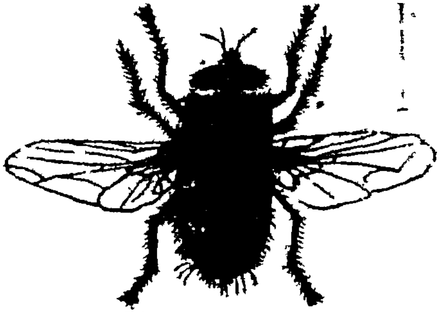


THE LOCUST MITE:—Greatly enlarged.

Though when it infests its victim in small numbers this last does not materially suffer, and though some people maintain that it is a natural and harmless belonging of the locust, yet it sometimes so thickly infests the flying swarms as to cripple, debilitate and kill large numbers.

The Anonymous Tachina Fly.—Our locust, like so many other insects, is also subject to the attacks of certain two-winged flies much resembling the common House-fly, but larger. One is the very same Tachina-fly (*Tachina anonyma*) which Prof. Riley has bred from a number of other insects.*

[Fig. 7.]

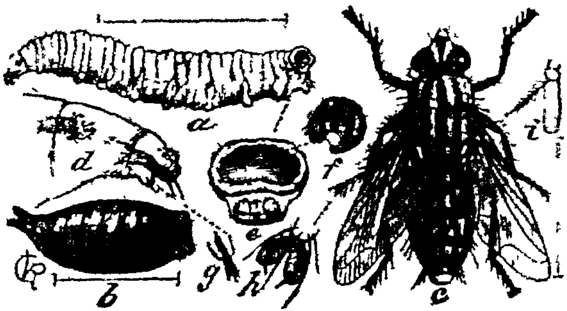


Tachina-fly.

These Tachina-flies firmly fasten their eggs—which are oval, white, and opaque, and quite tough—to those parts of the body not easily reached by the jaws and legs of their victim, and thus prevent the egg from being detached. The slow-flying locusts are attacked while flying, and it is quite amusing to watch the frantic efforts which one of them, haunted by a Tachina-fly, will make to evade its enemy. The fly buzzes around, waiting her opportunity, and when the locust jumps or flies, darts at it, and attempts to attach her egg under the wing or on the neck. The attempt frequently fails, but she perseveres, until she usually accomplishes her object. With those locusts which fly readily, she has even greater difficulty; but though the locust tacks suddenly in all directions in its efforts to avoid her, she circles close around it, and generally succeeds in accomplishing her purpose, either while the locust is yet on the wing, or, more often, just as it alights from a flight or a hop. The young maggots, hatching from these eggs, eat into the body of the locust, and after rioting on the fatty parts of the body—leaving the more vital parts untouched—they issue and burrow in the ground, where they contract to brown, egg-like pupæ, from which the fly issues either in the same season or not till the following spring. A locust infested with this parasite is more languid than it otherwise would be; yet it seldom dies till the maggots have left. Often in pulling off the wings of such as are hopping about, the bodies present the appearance of a mere shell, filled with maggots: and so efficient is this parasite that the ground in parts of the Western States is often covered with the Rocky Mountain Locust dead and dying from this cause.

The Common Flesh-fly (*Sarcophaga carnaria*, Linn.)—This fly, which is at once distinguished from the Tachina-fly by the style of the antennæ being hairy (Fig. 8, *i*,) instead of smooth, is also a great enemy of the Rocky Mountain Locust, though it should perhaps be looked upon more as a scavenger than an active parasite, being attracted more especially to those specimens which are feeble or already dead. These flesh-flies deposit living larvæ, which are distinguish from those of the Tachina-flies, by being more concave and truncated at the posterior end, but resemble them in general appearance, and in leaving the locust and burrowing in the ground to transform.

[Fig. 8]



Sarcophaga carnaria.—*a*, larva, *b*, pupa, *c*, fly. the hair lines showing average natural lengths; *d*, enlarged head and first joint of larva showing curved hooks, lower lip, *g*, and prothoractic spiracles; *e*, end of body of same, showing stigmata, *f*, and prolegs and vent; *k*, tarsal claws of fly with protecting pads; *i*, antenna of same enlarged.

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* See his Reports., 4, p. 129, and 5, p. 133.

All these natural agencies should be, as far as possible, encouraged. We can encourage the increase of the birds mentioned by enacting wise game laws to prevent their wholesale slaughter, and we may encourage some of the parasitic and predaceous insects, by importing those like the Ichneumon-flies, known to attack locust eggs in Europe, and by introducing some of the species enumerated into parts of the country where they do not occur; but in the main these insect enemies of our locust are beyond man's influence, and they will do their appointed work without his assistance.

2. Artificial Means of destroying the Eggs.—In the destruction of the eggs, man can accomplish much in his warfare with the insect. This fact has long been recognized in all European and Asiatic countries that suffer from locust depredations..

The eggs are laid in masses, just beneath the surface of the ground, seldom to a greater depth than an inch; and high, dry ground is preferred for the purpose. Very often the ground is so completely filled with these egg masses, that not a spoonful of soil can be turned up without exposing them, and a harrowing or shallow plowing will cause the surface to look quite whitish as the masses break up and bleach from exposure to the atmosphere.

Plowing the eggs under deeply destroys them either entirely or in great part, and if some survive, the young hatch so late the next season, that their power for harm is much lessened. Care should be had not to bring the eggs turned under in autumn to the surface again, by plowing the same land the following spring; for, thus brought to the surface, the eggs more often hatch.

The experience as to deep plowing under of the eggs is somewhat conflicting, and in some light, dry soils the larger number of them will hatch late if turned under a foot; yet, from our own observations, and a vast amount of experience gathered together, we recommend it as profitable. If delayed till spring it should be done just as the young begin to hatch, as it is then most effectual. Irrigation, or alternate submersion and drying of land is also useful in destroying the eggs, and where the ground is light, excessive moisture soon rots them. Just as excessive moisture is fatal to the eggs, so is excessive dryness, or direct exposure to the atmosphere, so that they receive alternately the direct rays of the sun and the rains and the dews. Consequently, harrowing or dragging the ground in the Fall where these eggs are laid, so as to break up the glutinous masses and expose the eggs to the influences mentioned, and to the more easy detection of birds and the other enemies spoken of, is greatly to be recommended. Wherever hogs and cattle can be turned into the fields where the eggs abound, most of these will be destroyed by the rooting and tramping. All these means are obviously insufficient, however, for the reason that the eggs are too often placed where none of them can be employed. In such cases they should be collected and destroyed by the inhabitants.

Experience indicates that of all these methods of destroying the eggs, harrowing or dragging the ground in the Fall is the most simple and satisfactory, and can be most generally and cheaply employed.

3. Destruction of the Young or unfledged Locusts.—Heavy rolling, where the surface of the soil is sufficiently firm and even, destroys a large number of these newly hatched young, but is most advantageously employed when they are most sluggish and inclined to huddle together, as during the first eight or ten days after hatching, and in the morning and evenings subsequently. They then drive almost as readily as sheep, and may be burned in large quantities by being driven into windrows or piles of burning hay or straw. They may also be killed with kerosene, and by means of flattened beating implements; wooden shovels being extensively used for this purpose in Europe.

But to protect the crops and do battle to these young locust armies, especially where, as was the case in much of the ravaged country in 1875, there is little or no hay or straw to burn, the best method is ditching. A ditch two feet wide and two feet deep, with perpendicular sides, offers an effectual barrier to the young insects. They tumble into it and accumulate, and die at the bottom in large quantities. In a few days the stench becomes great, and necessitates the covering up of the mass. In order to keep the main ditch open, therefore, it is best to dig pits or deeper side ditches at short intervals, into which the 'hoppers will accumulate and may be buried. Made around a field about hatching time, few 'hoppers will get into that field till they acquire wings, and by that time the principal danger is over, and the insects are fast disappearing. If any should hatch within the enclosure, they are easily driven into the ditches dug in different parts of the field. The direction of the apprehended approach of the insects being known from their hatching locality, ditching one or two sides next to such locality is generally sufficient, and when farmers join they can construct a long ditch, which will protect many farms.

We have not a doubt but that with proper and systematic ditching early in the season, when the insects first hatch, everything can be saved. Where water can be let into the ditches so as to cover the bottom they may be made shallower, and still be effective.

A ditch three feet wide, unless correspondingly deep, will be more apt to permit the escape of the insects when once in than a narrower one. In hopping, the more perpendicular the direction the insects must take the shorter will be the distance reached. Of course the wider the ditch, if it be correspondingly deep, the more effectual will it prove. In exceptional cases when the locusts are nearly full grown and the wind is high so as to assist them, even the two-foot ditch loses much of its value.

Next to ditching the use of nets or seines, or converging strips of calico or any other material, made after the plan of a quail net, has proved most satisfactory. By digging a pit, or boring a post auger hole, three or four feet deep, and then staking the two wings so that they converge toward it, large numbers of the locusts may be driven into the pit after the dew is off the ground. By changing the position of this trap, much good can be done when the insects are yet small and huddled in schools; but all modes of bagging, netting, crushing with the spade or other flat implements and burning, which can be employed to good advantage when the insects first begin to hatch, become comparatively useless when they begin to travel in concert over wide stretches of land. The same may be said of all the mechanical contrivances to facilitate the destruction of the insects; they are useful if used in concert in a given neighborhood soon after the young hatch, but subsequently do not compare to ditching. There are a number of contrivances that have been more or less successfully used, but we cannot treat of all of them in detail. We shall, rather, content ourselves with descriptions of a few, which will illustrate the principles to be kept in view. Those used in Minnesota, so far as we can learn, are applications of one principle, viz., an open-mouthed bag, dragged by hand or horse power. We have seen a very large one that would take from eight to twelve bushels of pupæ per day; but this was after the insects had been pretty effectually fought by burning and otherwise. It was very effective. Its owner proposes to place his whole dependence on it next year. It had one addition over others that we think valuable. It ran back ten feet or more to a bag, and near the rear end two or three square feet of cloth had been cut out and replaced by wire gauze. This gave a chance for the air to draw through, and as the locusts worked toward the rear end they made way toward the light shining through the wire. This machine was rigged on cart wheels, and the only expense was in getting three long poles from the woods, and in purchasing about forty yards of cotton muslin.

Major J. G. Thompson, of Garden City, Minnesota, has used with satisfaction, a net made as follows:

> Two pieces of common batten about sixteen feet long were used as a frame-work for the mouth of the net, one for the bottom and one for the top. From the end of the bottom piece a wooden shoe of the same material ran back about six feet to steady the trap and serve as a runner. To the rear end of this shoe a similar piece was fastened by a hinge, and ran forward and was fastened to the top-piece of the frame, so that the mouth of the trap would open and shut like a jaw. To hold the mouth open, two short, upright posts were fastened to the top-piece by a hinge, and rested upright upon the bed piece. The net itself was made of cotton cloth for the bottom, and the top was made of mosquito netting. The mouth of the net extended sixteen feet from one side of the trap to the other, and the net ran back about six feet to a point, with a hole at the end to let out the insects collected. A boy ten years old can draw one end of this net, and by the use of it Mr. Thompson saved one piece of wheat.

Similar machines have been drawn by horses hitched to each side of the trap, being twelve to sixteen feet apart. The horses serve the purpose of driving the locust inward toward the mouth of the net. There have been many forms of these machines, but all on the same general principle.

In Colorado, also, machines have been used to good advantage, most of them having for their object the burning of the young insects. Mr. J. Hetzel, of Longmont, uses a burner drawn by horses. It is 12 feet long, 2 to 2½ feet wide, and made of iron, set on runners 4 inches high. An open grate on the top of the runners is filled with pitch pine wood, and a sheet covers the grate to keep the heat down. The grate is generally made with a net-work of heavy wire, such as telegraph wire. Two men and a team will burn 10 to 12 acres a day, and kill two-thirds of the insects, but it requires a hot fire. Mr. C. C. Horner gives in the *Colorado Farmer* the following more detailed description of a machine which works on the same principle.

> It consists of three runners made of 2 x 4 scantling three feet in length, to be placed six feet apart, making the machine twelve feet wide, runners to be bound together by three flat straps or bars of iron (the base being 12 feet long). Across the top, bars of iron hold the runners firmly together and form a frame across which wire can be worked, to make a grate to hold fire. The upper part of the runners should be hollowed out so that the grate may glide along within two inches of the ground. A sheet-iron arch should be set over this grate to drive the heat downward. This machine is very light, and can be worked with one horse; pitch-wood is best adapted for burning, and can be chopped the right length and size and left in piles where most convenient, when needed. This machine is intended to be used when the

little 'hoppers just make their appearance along the edge of the grain, going over the ground once or twice each day, or as often as necessary to keep them killed off. The scorching does not kill the grain but makes it a few days later. This is certainly the cheapest manner of getting rid of this pest, as well as the most effectual.

Mr. Rufus Clark, of Denver, according to the same paper, uses a piece of oil cloth, nine to twelve feet long, and six feet wide; one side and each end is secured to light wooden strips by common carpet tacks, and the corners strengthened by braces.

The oil cloth is smeared with coal tar, purchased at the Denver Gas Works for $7.50 per barrel, and the trap is dragged over the ground by two men—a cord about ten feet long being fastened to the front corners for that purpose. The entire expense of the "trap" is about $3.50, and as it is light and easily handled will be found serviceable on small as well as large farms.

Zinc instead of oil cloth has also been used for the same purpose.

When the insects are famishing, it is useless to try and protect plants by any application whatever, though spraying them with a mixture of kerosene and warm water is the best protection we have tried, and will measurably answer when the insects are not too numerous or ravenous.

The best means of protecting fruit and shade trees deserves separate consideration. Where the trunk is smooth and perpendicular, they may be protected by whitewashing. The lime crumbles under the feet of the insects as they attempt to climb, and prevents their getting up. By their persistent efforts, however, they gradually tear off the lime and reach a higher point each day, so that the whitewashing must be often repeated. Trees with short, rough trunks, or which lean, are not very well protected in this way. A strip of smooth, bright tin answers even better for the same purpose. A strip three or four inches wide brought around and tacked to a smooth tree will protect it; while on rougher trees a piece of old rope may first be tacked around the tree and the tin tacked to it, so as to leave a portion both above and below. Passages between the tin and rope or the rope and tree can then be blocked by filling the upper area between tin and tree with earth. The tin must be high enough from the ground to prevent the 'hoppers from jumping from the latter beyond it; and the trunk below the tin, where the insects collect, should be covered with some greasy or poisonous substances to prevent girdling. This is more especially necessary with small trees; and kerosene or whitewash having Paris green mixed with it will answer as such preventives.

One of the cheapest and simplest modes is to encircle the tree with cotton batting into which the insects will entangle their feet, and thus be more or less obstructed. Strips of paper covered with tar, stiff paper tied on so as to slope roof-fashion, strips of glazed wall paper, thick coatings of soft soap, have been used with varying success; but no estoppel equals the bright tin; the others require constant watching and renewal, and in all cases coming under our observation some insects would get in to the trees so as to require the daily shaking of these morning and evening. This will sometimes have to be done when the bulk of the insects have become fledged, even where tin is used; for a certain proportion of the insects will then fly into the trees. They do most damage during the night, and care should be had that the trees be unloaded of their voracious freight just before dark.

Finally, most cultivated plants may be measurably protected from the ravages of these young by good cultivation and a constant stirring of the soil. The young have an antipathy to a loose and friable surface, which incommodes them and hinders their progress; and they will often leave such a surface for one more hard and firm.

4. Destruction of the winged Locusts.—The destruction of the winged insects when they swoop down upon a country in prodigious swarms, is impossible. Man is powerless before the mighty host. Special plants, or small tracts of vegetation may be saved by perseveringly driving the insects off, or keeping them off by means of smudges, as the locusts avoid smoke, or by rattling or tinkering noises constantly kept up. Long ropes perseveringly dragged over a grain field, have been used to good advantage. Great numbers may be caught and destroyed by bagging and crushing, as recommended for the new-fledged; and we more particularly urge their destruction in this way late in the season when early and late in the day they are comparatively sluggish; but as a rule the vast swarms from the West or Northwest will have everything their own way. In the latitude of St. Louis these invading swarms usually come too late to affect the small grains, or to materially affect corn; but further north they are more to be dreaded, and the experience of Minnesota and Dakota farmers teaches that one of the best ways of avoiding their injuries is to grow such crops as will mature early.

5. Possible Prevention.—The measures so far recommended have in view the destruction of the insects when once they are upon us. We believe that important results are likely to flow from a horough study of the Rocky Mountain Locust in its native haunts and breeding places. By learning just when and how to strike the insect, so as to prevent its undue multiplication—whether by some more extensive system of irrigation, based on improved knowledge of the topography and water supply of the country, or by other means of destroying the eggs—we may hope to protect the fertile States to the East from future calamity.

We may expect good from the encouragement of native locust-feeding birds. Some system of preventing the extensive prairie fires in fall that are common in the country where the insect naturally breeds, and then subsequently firing the country in the spring after the young hatch and before the new grass gets too rank, might be adopted. But whatever the means employed, they must be carried on systematically and on a sufficiently extended and comprehensive scale; and we have already, in the Proceedings of the Conference, shown how important we deem in this connection, some action on the part of the National Government. We have made a strong appeal to the next Congress, and we urge the people of the West through their granges and through their agricultural and horticultural societies, to instruct their Senators and Representatives at Washington, to use their influence in bringing about the needed legislation. The following resolutions were unanimously adopted at the late session of the National Agricultural Congress held at Philadelphia, and deserve wide circulation:

WHEREAS, The people of some of the Western and Northwestern States have again been afflicted by the Rocky Mountain locust scourge; and,

WHEREAS, The devastations of this insect form the most serious obstacles to the settlement and welfare of much of the country between the Mississippi and the mountains, and have become a national calamity; and,

WHEREAS, There is much to learn of the native breeding places of the pest, and some hope that by more thorough knowledge of those native breeding places, and the causes of migration therefrom, we may be able to prevent invasion into the more fertile country to which the species is no indigenous; therefore,

Resolved, That it is the emphatic opinion of this Congress that some action should be taken by the National Government that will have for its object the palliation or extinction of this crying evil.

Resolved, That we consider that Congress owes it to the people of the West to take this matter into consideration, and we call upon the next National Legislature to follow the example of other nations, under like circumstances, and appoint a special commission for the thorough investigation of the subject.

SUGGESTIONS THAT MAY PROVE SERVICEABLE.

Hogs and poultry of every description delight to feed on the young locusts and will flourish where these abound when nothing else does. We recommend our farmers to provide themselves with as large a quantity as possible of this stock. Where no general and systematic efforts have been made to destroy either the eggs or the young locusts, and it is found that, as springs opens, these young hatch out in threatening numbers, the intelligent farmer will delay the planting of everything that cannot be protected by ditching until the very last moment, or till the insects become fledged—using his team and time solely in the preparation of his land. In this way he will not only save his seed and the labor of planting, and, perhaps, replanting, but he will materially assist in weakening the devouring armies. Men planted in 1875 and worked with a will and energy born of necessity, only to see their crops finally taken, their seed gone, and their teams and themselves worn out. The locusts in the end destroyed every green thing, until, finding nothing more, they began to fall upon each other and to perish. This critical period in their history would have been brought about much earlier if they had not had the cultivated crops to feed upon; and if by concert of action this system of non-planting could at first have been adopted over large areas, the insects would have been much sooner starved out and obliged to congregate in the pastures, prairies and timber. Moreover the time required for early planting and cultivation, if devoted to destroying the insects after the bulk of them hatch out toward the end of April, would virtually annihilate them.

Too much stress cannot be laid on the advantages of co-operation and concert of action, to accomplish which ought not to be difficult, with our present Grange system. To insure concert of action, it would be well to authorize the supervisors of each school district to call out every able-bodied man and oblige him to work in a general system of destruction as soon as the bulk of the young insects have hatched, and the same would apply equally as well to the destruction of the eggs.

STATE LEGISLATION.

The Conference having by resolution, recommended that each of the States and Territories most deeply interested in the locust question enact a State bounty law for the destruction of the eggs and young insects, and as the legislatures of several of these States will doubtless be led to pass acts for protection against locust ravages, we will briefly state what we conceive should be the essential features of any act having that object.

1. *The bounty should be paid out of the State Treasury; or it should be graded and borne equally, one-third by the local Township, one-third by the County, and one-third by the State.* When any State or portion of a State is afflicted by a locust visitation, the people of the State at large should partly bear the burden. By a judicious State bounty system that would avert future calamity in any threatened district, the more prosperous portion of the community is made to contribute to the relief of the afflicted, and the whole community in reality gains by the operation.

2. *The bounty should be immediately available to those earning it.* When distress and want stare the people of a locust-stricken district in the face, those who work for a bounty should be able to obtain it with as little delay as possible. This result can, perhaps, best be attained by empowering the Township Trustee, or the Street Commissioner, to receive and measure the eggs or young insects, and to issue certificates setting forth the number of bushels destroyed—the certificates to be filed with the County Clerk, who should issue to the claimant another certificate, setting forth the name and residence of the holder, and the number of bushels of eggs and young locusts collected and destroyed by him. This last certificate should be taken and received by the Collector of the Revenue of the county in which the same was given, and such collector should pay the holder thereof the sum called for under the act, and be allowed pay out of the State Treasury for the same.

3. *The act should, as far as possible, tend to the destruction of the Eggs.* Barring exceptional cases, where shallow plowing or harrowing can be resorted to, and where the eggs are abundant, the collecting of these eggs will be tedious. It will be safe, therefore, to offer a pretty large inducement to collect them, and $4 to $6 a bushel would not be too much, and would give a remunerative employment to young people through the mild weather of winter and in late fall and early spring.

4. *After the eggs, the destruction of the newly hatched Locusts should be encouraged by the Act.* A bushel of the newly hatched insects will contain thirty or more times as many individuals as will a bushel of the pupæ, and, moreover, their destruction prevents the subsequent injury. It would be folly to pay sixty cents a bushel for them later in the season when they are nearly full grown and have done most of the harm they are capable of doing. The price, therefore, should vary with the season; and while, in latitude 39°, 75 cents or $1.00 should be offered in March, the price should diminish to 50 cents in April, 25 cents in May, and 10 cents in June. As the dates of hatching vary with the latitude, so the law should vary in the matter of dates, according to the requirements of each particular State. In addition to the foregoing requirements of such an act, every precaution should be taken to prevent fraud and dishonesty in obtaining the money.

The prices here suggested are all sufficient, as we must not forget that, aside from the bounty inducement, the people who appreciate the situation must feel that they are working for self-protection, and know that it is folly to waste labor in any other way. A bounty law once enacted and on the Statute books, may not be called into operation very often, but will serve an admirable purpose in the event of an invasion such as we have had the present year.

In the more thinly settled parts of the country, a State bounty system may be more or less ineffectual, so far as the general destruction of the insects is concerned, though it will even there be one of the best means of relieving destitution; but in the more settled counties it will accomplish both ends.

Some act that would authorize the street or road commissioner to have the roadside and other bare places where the eggs have been laid, thoroughly harrowed in the Fall—calling out for the purpose all who owe road tax, and any additional force required, to be duly paid for—would also work admirably, and be, perhaps, productive of more good at less expense than the other means.

CONCLUSION.

In the foregoing recommendations we have endeavored to bring together the more important facts regarding this locust. There is much more remains unsaid. In closing, let us recapitulate in part, and urge courageous action.

In the larger portion of many of the Western States, the ground is now literally filled near the surface with eggs, especially in newly turned sward, in wheat fields, in bare, sunny places, along hill sides and along roads. The last locusts of this year's race have been buried in the first winter's storm, and have perished to be seen no more. Their absence should not make the farmer forgetful of the the seed of destruction they have left, or of the real danger that threatens.

We hear a great deal about the work of different parasites on the eggs, and unobserving writers are already claiming that the eggs are all going to be destroyed by these parasites; many of these eggs are also rotting from excessive moisture, while a certain proportion of them have been hatching in some sections. But, if between this and the re-opening of spring, nine-tenths of the eggs should be destroyed from one cause and another over large portions of the country, the one-tenth would still give birth to locusts enough to devour every green thing. The danger is great, and there is no use in disguising it. With a mild and alternately freezing and thawing winter, the great bulk of the eggs may be destroyed, and, instead of the disasters of 1875, we may have the comparative harmlessness of 1867. This, we repeat, is possible, but it will not do to count on. Let us rather prepare for the worst.

WORK TO BE DONE.

In order to lay stress on the work to be done we will briefly recapitulate.

Protect your fields and prairies, as far as possible, from burning this Fall. Ask your railroad managers to co-operate by burning coal during the dry weather, and by instructing their section masters to have a few hundred feet carefully burned each side of their track. Then set all these fields on fire next spring after the young hatch and before they commence to travel.

Save all straw, old hay, and other cheap, combustible material that can be got, to use in the spring in burning the young.

Harrow and drag wherever you can. This is the best work that can be done in the Fall. A revolving harrow will more than pay for itself on newly turned ground, and a sharp-toothed harrow can be used to good advantage on the bare and uncultivated places and along roadsides where the eggs are known to be laid.

Ditch! Commence at once to surround your field or garden with a ditch such as here recommended. Employ the first two weeks that would otherwise be devoted to planting next spring either to ditching or making pits or to plowing or deep harrowing. Don't plant until, by burning, crushing and trapping or starving, you have got rid of the bulk of the pests.

Sow your grain in "lands" or strips fifty to one hundred feet wide, to permit of ditching between them, and those of you who have fall wheat up and doing well, where the eggs are thickly laid, should make ditches at intervals through the field to facilitate the saving of it in the spring,

Organize, so as to insure intelligent and concerted action.

Demand of your legislature, that it enact a bounty law which will render the labor bestowed on the destruction of the eggs, not only valuable as preventing injury to yourselves, but doubly remunerative to those who will take the trouble to collect them. With a good harrow and a proper sieve, better wages could be earned by many, both young and old, at collecting locust eggs at $5 per bushel, than can be earned at much other work; and a few thousand dollars taken from the State Treasury for such a purpose would be well expended.

Do not rely on one, but employ all available means.

Demand State legislation that will secure the services of some competent person to canvass the State, in order to indicate where the greatest danger threatens, and to facilitate organization, and the distribution of documents containing desired information.

Demand national legislation that will look to possible prevention. Instruct your representatives at Washington to urge the legislation we have asked for.

Make provision for procuring as large a supply of hogs, and of hatching as large a number of chickens, turkeys and ducks, next spring, as possible.

Above all, do not get discouraged!

Come what may, do not ask for outside aid! We do not believe there ever will be any need of it: it is, in the end, demoralizing.

The elements may, ere spring, conspire to an almost total destruction of the eggs, though, as we have said, it will not do to trust to such an occurrence. But let the worst come that can, and you may, by carrying out the suggestions here given, remain masters of the field. In any event you have the assurance that the evil is only temporary. The insects will leave in time to enable you to raise, with fair weather, good crops of many products, and you may not be visited again for several years. The people are in much better condition to stand loss next spring than they were two years ago. There is no part of the country that is not subject to meteorological or entomological excesses, and in the long run the locust is not more injurious than are some insects in other parts of the country. When we think of the famine and utter destitution that at times overtake some of the Eastern peoples, we may well thank the Almighty that we live in a land of such resources and promise. The threatened country has prospered in the past: it will prosper in the future; and in proportion as we meet this locust enemy with enterprise and concerted, intelligent action, in that proportion shall we vanquish it.

ERRATA.

On p. 1, last line, omit "e" in "Osborne."
On p. 2, after l. 1, add "Ex-Gov. Alvin Saunders."
On p, 14, l. 2, for "recommendation," read "expedient"